



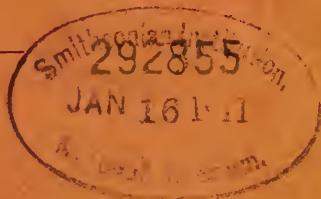


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MADRAS GOVERNMENT MUSEUM.

Bulletin No. 1.

PEARL AND CHANK FISHERIES
OF THE
GULF OF MANAAR.

BY
EDGAR THURSTON, C.M.Z.S., ETC.,
Superintendent, Madras Government Museum.



MADRAS:
PRINTED BY THE SUPERINTENDENT, GOVT. PRESS.

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P R E F A C E.

IN 1890, my 'Notes on the Pearl and Chank Fisheries and Marine Fauna of the Gulf of Manaar' were published in a single volume; and a friendly critic pointed out that the effect thereof was somewhat marred by their publication together, and by the arrangement adopted.

The edition being exhausted, and fresh material awaiting incorporation, I have taken advantage of the opportunity to commence a series of bulletins, dealing with the results of my wanderings on behalf of the Madras Museum; and send forth the first issue in the form of a revised edition of the 'Note on Pearl and Chank Fisheries,' leaving the 'Marine Fauna of the Gulf of Manaar' to be dealt with hereafter.

EDGAR THURSTON,

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DESCRIPTION OF PLATES.

PLATE I.

Pearl oyster (natural size) with one valve of the shell removed:—

- a. byssus filaments with fragments of coral, from which they have been torn by the diver, attached;
- b. adductor muscle;
- c. 'ovarium,' wherein the pearls are situated;
- d. mantle.

PLATE II.

Fig. I. Section of pearl oyster, magnified:—

- a. alimentary canal;
- b. liver;
- c, c. generative tubes;
- d. organ of Bojanus.
- e, e. sections of parasites encysted between the alimentary canal and generative tubes.

Fig. II. Section of pearl oyster, magnified, showing portion of the byssus gland with the filaments arranged in laminæ, and invested by muscular and connective tissue.

PLATE III.

Fig. I. Section of pearl oyster, less highly magnified than the preceding, showing the byssus gland with its laminæ, invested by muscular and connective tissue, and surrounded by generative tubes.

Fig. II. Section of pearl oyster, magnified, showing ovum imbedded among generative tubes.

PLATE III-A.

Specimen of *Rhinodon typicus* preserved in the Madras Museum (length 22 feet).

PLATE IV.

Chank shell (*Turbinella rapa*), natural size.



“ Know you, perchance, how that poor formless wretch—
The Oyster—gems his shallow moonlit chalice?
Where the shell irks him, or the sea-sand frets,
This lovely lustre on his grief.”

Edwin Arnold.

I.—TUTICORIN PEARL FISHERY.

TUTICORIN, the “ scattered town,” situated in the Tinnevely district on the south-west coast of the Gulf of Manaar, from which the Madras Government pearl fisheries are conducted, is, according to Sir Edwin Arnold,¹ a sandy maritime little place, which fishes a few pearls, produces and sells the great pink conch shells, exports rice and baskets, and is surrounded on the land side by a wilderness of cocoa and palmyra palms. Summed up in these few words, it does not appear the important place which, in spite of its lowly aspect when viewed from the sea and the seeming torpor which reveals itself to the casual visitor, it is in reality. For not only is it a medium of communication between Tinnevely and Ceylon, to and from which hosts of coolies are transported in the course of every year, but it is also an important mercantile centre for the shipment of Tinnevely cotton (the most valuable of the cottons grown in the Madras Presidency), jaggery,² (molasses), onions, chillies, etc.

With respect to the shipment of jaggery, I was told, during a visit to Tuticorin, that, during the seasons at which jelly-fish abound in the muddy surface water of the Tuticorin harbour, so great is the dread of their sting, that coolies, engaged in carrying loads of jaggery on their heads through the shallow water to the cargo boats, have been known to refuse to enter the water until a track, free from jelly-fish, was cleared for them by two canoes dragging a net between them.

¹ *India Re-visited*, 1887.

² “ The fresh juice of the palmyra palm, if boiled down, yields molasses or jaggery, from which sugar may be refined. The juice collected for this purpose has a small piece of lime placed in it to prevent fermentation while suspended from the tree.”—(*Dict. Econom. Prod.*).

Tuticorin is, indeed, as Sir Edwin Arnold records, "an abominable place to land at." Nature has unfortunately ordained that large vessels are unable to approach nearer to the shore than a distance of six miles or thereabouts. A due regard for their safety compels them to lie at anchor outside Hare Island, one of a number of coral-girt islands in the neighbourhood, where hares and partridges may be shot, and sluggish holothurians (*béches de mer*) captured in abundance at low tide as they lie impassive on the sandy shore, which is strewn with broken coral fragments, detached by wave-action from the neighbouring reef, and riddled with the burrows of nimble ocy pods (*O. macrocera* and *O. ceratophthalma*.)

Not far from the north end of the town of Tuticorin, on the sandy shore, are the kilns, in which corals, coarse mollusc shells (*Ostræa*, *Venus*, *Cardium*, &c.) and melobesian nodules (calcareous algæ) are burned and converted into *chunám*,³ i.e., prepared lime used for building purposes, and by natives for chewing with their beloved betel (the leaves of *Piper Betle*). A Native friend informs me that in Northern India pearls are bought by wealthy natives to be used instead of *chunám* with the betel. In India relations and friends put rice into the mouth of the dead before cremation, while in China seed pearls are used for the same purpose.

During my visit to Tuticorin in 1887, I used to watch, almost daily, grand, massive blocks of *Porites*, *Astræa*, and various species of other reef-building coral genera, being brought in canoes from the reefs, and thrown into the ground to form the foundation of the new cotton mills, which, in consequence, bear the name of the Coral Mills.

Lecturing at the Royal Institution⁴ on the "Structure, Origin, and Distribution of Coral Reefs and Islands," Mr. John Murray stated that "if we except Bermuda and one or two other outlying reefs where the temperature may occasionally fall to 66° Fahr. or 64° Fahr., it may be said that reefs are never found where the surface temperature of the water, at any time of the year, sinks below 70° Fahr., and where the annual range is greater than 12° Fahr. In typical coral reef regions, however, the temperature is

³ The familiar house frog (*Rhacophorus maculatus*) of Madras is popularly known as the *chunám* frog from its habit of sticking by means of the discs on its toes on to the *chunám* walls of dwelling houses.

⁴ March 16, 1888.

higher and the range much less." No regular series of records of the temperature of the water in the coral-bearing Gulf of Manaar has as yet been made. The surface temperature, which I recorded from time to time during my visit to Rámésvaram island in the latter half of July, 1888, varied from 79° Fahr. to 91° Fahr. between the hours of 7 A.M. and 6 P.M.

The following table shows the temperature range of Tuticorin during the year 1887, the readings being taken in the shade at 10 A.M. and 4 P.M. :—

				Range.	Min.	Max.
January	..	..	..	9°	75°	84°
February	..	..	..	6°	78°	84°
March	..	..	..	9°	80°	89°
April	..	..	..	12°	79°	91°
May	..	..	..	13°	83°	96°
June	..	..	..	9°	86°	95°
July	..	..	..	10°	86°	96°
August	..	..	..	11°	84°	95°
September	..	..	..	9°	85°	94°
October	..	..	..	6°	80°	86°
November	..	..	..	7°	79°	86°
December	..	..	..	11°	75°	86°

Tuticorin has been celebrated for its pearl fishery from a remote date, and, as regards comparatively modern times, Friar Jordanus, a missionary bishop, who visited India about the year 1330, tells us that as many as 8,000 boats were then engaged in the pearl fisheries of Tinnevely and Ceylon.

In more recent times the fishery has been conducted, successively, by the Portuguese, the Dutch, and the English. The following excellent description by Martin of the pearl fishery in the year 1700, during the Dutch occupation of Tuticorin, shows that the method of fishing adopted at that time agrees, in its essential characteristics, with that which is in vogue at the present day :—

"In the early part of the year the Dutch sent out ten or twelve vessels in different directions to test the localities in which it appeared desirable that the fishery of the year should be carried on; and from each vessel a few divers were let down who brought up each a few thousand oysters, which were heaped upon the shore in separate heaps of a thousand each, opened and examined. If the pearls found in each heap were found by the appraisers to be worth an *écu* or more, the beds from which the oysters were taken were held to be capable of yielding a rich harvest; if they were worth no more than thirty sous, the

beds were considered unlikely to yield a profit over and above the expense of working them. As soon as the testing was completed, it was publicly announced either that there would, or that there would not be a fishery that year. In the former case enormous crowds of people assembled on the coast on the day appointed for the commencement of the fishery; traders came there with wares of all kinds; the roadstead was crowded with shipping; drums were beaten, and muskets fired; and everywhere the greatest excitement prevailed, until the Dutch Commissioners arrived from Colombo with great pomp, and ordered the proceedings to be opened with a salute of cannon. Immediately afterwards the fishing vessels all weighed anchor and stood out to sea, preceded by two large Dutch sloops, which in due time drew off to the right and left and marked the limits of the fishery, and when each vessel reached its place, half of its complement of divers plunged into the sea, each with a heavy stone tied to his feet to make him sink rapidly, and furnished with a sack into which to put his oysters, and having a rope tied round his body, the end of which was passed round a pulley and held by some of the boatmen. Thus equipped, the diver plunged in, and on reaching the bottom, filled his sack with oysters until his breath failed, when he pulled a string with which he was provided, and, the signal being perceived by the boatmen above, he was forthwith hauled up by the rope, together with his sack of oysters. No artificial appliances of any kind were used to enable the men to stay under water for long periods; they were accustomed to the work almost from infancy, and consequently did it easily and well. Some were more skillful and lasting than others, and it was usual to pay them in proportion to their powers, a practice which led to much emulation and occasionally to fatal results. Anxious to outdo all his fellows, a diver would sometimes persist in collecting until he was too weak to pull the string, and would be drawn up at last half or quite drowned, and very often a greedy man would attack and rob a successful neighbour under water; and instances were known in which divers who had been thus treated took down knives, and murdered their plunderers at the bottom of the sea. As soon as all the first set of divers had come up, and their takings had been examined and thrown into the hold, the second set went down. After an interval, the first set dived again, and after them the second; and so on turn by turn. The work was very exhausting, and the strongest man could not dive oftener than seven or eight times in a day, so that the days' diving was finished always before noon.

"The diving over, the vessels returned to the coast and discharged their cargoes; and the oysters were all thrown into a kind of park, and left for two or three days, at the end of which they opened and disclosed their treasures. The pearls, having been extracted from the shells, and carefully washed,

were placed in a metal receptacle containing some five or six colanders of graduated sizes, which were fitted one into another so as to leave a space between the bottoms of every two, and were pierced with holes of varying sizes, that which had the largest holes being the topmost colander, and that which had the smallest being the undermost. When dropped into colander No. 1, all but the very finest pearls fell through into No. 2, and most of them passed into Nos. 3, 4, and 5; whilst the smallest of all, the seeds, were strained off into the receptacle at the bottom. When all had staid in their proper colanders, they were classified and valued accordingly. The largest, or those of the first class, were the most valuable, and it is expressly stated in the letter from which this information is extracted that the value of any given pearl was appraised almost exclusively with reference to its size, and was held to be affected but little by its shape and lustre. The valuation over; the Dutch generally bought the finest pearls. They considered that they had a right of pre-emption. At the same time they did not compel individuals to sell, if unwilling. All the pearls taken on the first day belonged by express reservation to the King or to the Sétupati according as the place of their taking lay off the coasts of the one or the other. The Dutch did not, as was often asserted, claim the pearls taken on the second day. They had other and more certain modes of making profit, of which the very best was to bring plenty of cash into a market where cash was not very plentiful, and so enable themselves to purchase at very easy prices. The amount of oysters found in different years varied infinitely. Some years the divers had only to pick up as fast as they were able, and as long as they could keep under water; in others they could only find a few here and there. In 1700 the testing was most encouraging, and an unusually large number of boat-owners took out licenses to fish; but the season proved most disastrous. Only a few thousands were taken on the first day by all the divers together, and a day or two afterwards not a single oyster could be found. It was supposed by many that strong under-currents had suddenly set in owing to some unknown cause. Whatever the cause, the results of the failure were most ruinous. Several merchants had advanced large sums of money to the boat-owners on speculation, which were, of course, lost. The boat-owners had in like manner advanced money to the divers and others, and they also lost their money."

In the present century the following fisheries have taken place:—

1822	..	..	..	profit	£13,000
1830	..	..	..	do.	£10,000
1860-62	..	..	..	do.	Rs. 3,79,297
1889	..	..	..	do.	„ 1,58,483
1890	..	..	..	do.	„ 7,803

As to the cause of the failure of the pearl oysters to reach maturity on the banks in large numbers, in recent times, except after long intervals, I for my part confess my ignorance. Whether the baneful influence of the mollusca known locally as súran (*Modiola*, sp.) and killikay (*Avicula*, sp.), the ravages of rays (*Trygon*, &c.) and file-fishes (*Balistes*), poaching, the deepening of the Pámban channel, or currents are responsible for the non-production of an abundant crop of adult pearl-producing oysters during more than a quarter of a century (1862-89) it would be impossible to decide, until our knowledge of the conditions under which the pearl oysters live is much more precise than it is at present.

The argument that the failure of the pearl fishery is due to poaching is from time to time, brought forward; but, as Mr. H. S. Thomas wisely and characteristically remarks: ⁵ "The whole system of the fishery has been carefully arranged, so that every one in any way connected with it has a personal stake in preventing poaching, and oyster poaching is not a thing that can be done in the night; it must be carried out in broad daylight; and, to be worth doing at all, it must be done on a large scale. Ten thousand oysters cannot be put in one's pocket like a rabbit, nor are there express trains and game-shops to take them. Every single oyster has to be manipulated, and it is only the few best that can be felt at once with the finger, and the usual way is to allow the oyster to rot and wash away from the pearl. Oysters could not be consigned fresh in boxes or hampers by rail to distant confederates; they could not even be landed without its becoming known; and, if known, every one is interested in informing the Government officer and stopping poaching." I cannot, however, refrain from quoting the following touching description of an ideal poach in a recent pamphlet: "Mutukuruppan and Kallymuttu are two fishermen brothers: they start out after their cold rice, ostensibly to get their lines ready in their canoe, and paddle away to their fishing ground; there they drop their stone anchor: presently one observes that it is warm and he would like a bathe; over the side he goes down by his mooring rope to see what the bottom is like. He brings up a handful of oysters and gives them to Thamby; then Thamby thinks

⁵ Vide *Report on Pearl Fisheries and Chank Fisheries*, 1884, by the Hon. Mr. H. S. Thomas.

he would like a bathe, and he goes down also, and brings up a fist full. When they are tired, they get back into the canoe and open their spoils, taking out what pearls they can find, and pitching the shells back into the sea. This sort of thing goes on day after day and year after year up and down the coast, and this will partially account for the dead shells so often found on the banks. Is it to be wondered at that oysters take alarm at this constant invasion of their domain and naturally seek some other place of rest?"

Far more prejudicial to the welfare of the oysters than an occasional raid upon them by a stray Mutukurupam or Kallymuttu is, in all probability, the little mollusc, *súran*, which clusters in dense masses over large areas of the sea bottom, spreading over the surface of coral blocks, smothering and crowding out the recently deposited and delicate young of the oyster. Time after time there is, in the carefully kept records of the superintendent of the pearl banks, in one year a note of the presence of young oysters, either pure or mixed with *súran* and mud or weed, while, at the next time of examination, generally in the following year, it is noted that the oysters have disappeared, and the *súran* remained. A few examples will suffice to make this point clear:—

*Deví Par*⁶— to $6\frac{1}{2}$ to $7\frac{1}{4}$ fathoms.

- May, 1881. Young oysters mixed with sooram⁷ and mud.
 „ 1882. Sooram.

Permandu Par—6 to $6\frac{1}{4}$ fathoms.

- May, 1880. A few oysters of one year age.
 „ 1881. Young oysters mixed with sooram and mud.
 „ 1882. Sooram.

Athombadu Par— $7\frac{3}{4}$ to 9 fathoms.

- May, 1880. Covered with sooram.
 „ 1881. Large number of oysters of one year age, with sooram in some places and covered with weeds.
 „ 1882. No oysters; sooram in some places.

The bank, which was fished during the fishery of 1889, is situated about 10 miles east of Tuticorin, and known as the

⁶ *Par* or *puar* = bank.

⁷ *Sooram* = *súran*.

Tholayiram Par, the condition of which, as regards oyster supply, since the year 1860, is shown by the following extract from the records of the superintendent of pearl banks :—

April, 1860.	Plenty of oysters 3½ years old.
Nov., 1861.	Oysters scarce ; nearly all gone.
April, 1863.	Sooram and killikay with some young oysters.
Nov., 1865.	} Blank.
April, 1866.	
Nov., 1867.	
April, 1869.	
Mar., 1871.	Five oysters with a quantity of sooram.
Feb., 1872.	Five oysters of 3 years age found.
May, 1873.	Three oysters found.
Jan., 1875.	Three oysters of 2 years age found.
Mar., 1876.	North part blank.
April, 1877.	South part blank.
Nov., 1878.	Thickly stocked with oysters of 1 year age.
May, 1879.	} Blank.
Nov., 1880.	
Nov., 1881.	Some oysters of 1 year mixed with killikay.
Nov., 1882.	No living oysters ; dead shells and sooram.
April, 1883.	Three oysters found.
Mar., 1884.	Plenty of oysters of one year age ; clean and healthy.

From 1884 the Tholayiram Par was carefully watched, and the growth of the oysters continued steadily, unchecked by adverse conditions, as the following figures show :—

10 shells lifted.	{	March, 1884	weighed 1 oz.
	{	October, "	3¾ "
	{	March, 1885	6¼ "
	{	October, "	7 "
	{	April, 1886	7½ "
	{	November, "	8½ "
	{	March, 1887	10¾ "
	{	October, "	13 "
	{	November, 1888	15¼ "

In November, 1888, 15,000 oysters were lifted, and their product valued by expert pearl merchants at Rs. 206-13-9, i.e., Rs. 13-12-8 per thousand,^s as shown by the following copy of the statement of valuation :—

^s The product of 12,000 oysters lifted from the Ceylon pearl bank, the fishing of which took place synchronously with that of the Tuticorin bank, in November, 1888, was valued at Rs. 122. A further sample of 12,650 oysters, lifted in February, 1889, was valued at Rs. 142.

Description.	Size in basket.	Number.	Quantity in chevu.	Weight.			Value.	Total value.	Per chevu.	Per kalungy.
				Kalungy.	Manjady.	Total. Kalungy. Manjady.				
Ani ..	20	1	158/320	...	1 $\frac{3}{8}$	1 $\frac{3}{8}$	RS. A. P. 43 3 0	RS. A. P. 43 3 0	25 star pagodas.	
Kuruvel	30	1	25/320	...	1 $\frac{6}{16}$	1 $\frac{6}{16}$	4 6 0	4 6 0	16 do.	
Kalippu	50	6	45/320	...	1 $\frac{13}{16}$	1 $\frac{13}{16}$	7 14 0	7 14 0	16 do.	
Pisal ...	50	3	...	...	1 $\frac{13}{16}$	1 $\frac{13}{16}$	0 10 0	0 10 0	4 do.	
Kodai	20	4	...	...	1 $\frac{3}{8}$	1 $\frac{3}{8}$	0 10 3	0 10 3	3 do.	
Vadivu	100	...	176/320	...	6 $\frac{1}{4}$	6 $\frac{1}{4}$	77 0 0	77 0 0	...	22 star pagodas.
Do.	200	...	112/320	...	6 $\frac{3}{4}$	6 $\frac{3}{4}$	5 7 6	5 7 6	...	10 do.
Pisal	...	...	...	...	3 $\frac{1}{4}$	3 $\frac{1}{4}$	7 0 0	7 0 0	...	5 do.
Kodai	...	...	...	...	8	8	0 5 6	0 5 6	...	1 do.
Tal ...	600	...	...	...	1 $\frac{3}{16}$	1 $\frac{3}{16}$	42 14 0	42 14 0	...	7 do.
Mosie	800	...	...	1 $\frac{3}{16}$	...	...	16 6 6	16 6 6	...	3 $\frac{1}{2}$ do.
Shell pearl	1,000	...	...	1 $\frac{9}{16}$	5	5	1 1 0	1 1 0	...	
Total ...							206 13 9	206 13 9		
Average per 1,000 oysters ...							13 12 8	13 12 8		

It may not be out of place to elucidate the meaning of some of the terms used in the above statement, and I cannot do better than quote from the excellent article on the Pearl Fisheries of Ceylon by Mr. G. Vane, C.M.G., who writes as follows⁹ :—

“Sorting and sizing the pearls into ten different sizes, from the largest to the smallest, is done by passing them through ten brass sieves of 20, 30, 50, 80, 100, 200, 400, 600, 800, and 1,000 holes each of the ten sizes may include some of every class of pearls; the 20 to 80 and 100 may each have the *āṇi*, *anātari*, and *kallipū* kinds, and this necessitates the operation of classing, which requires great judgment on the part of the valuers.

“Perfection in pearls consists in shape and lustre, viz., sphericity and a silvery brightness, free from any discolouration; and, according as the pearls possess these essentials, the valuers assign their appropriate class, namely,—

“ <i>Āṇi</i>	Perfect in sphericity and lustre.
“ <i>Anātari</i>	Followers or companions, but failing somewhat in point of sphericity or lustre.
“ <i>Masaṅkú</i>	Imperfect, failing in both points, especially in brilliancy of colour.
“ <i>Kallipū</i>	Failing still more in both points.
“ <i>Kural</i>	A double pearl, sometimes <i>āṇi</i> .
“ <i>Pīsal</i>	Misshapen, clustered, more than two to each other.
“ <i>Maḍaṅku</i>	Folded or bent pearls.
“ <i>Vaḍivu</i>	Beauty of several sizes and classes.
“ <i>Tūl</i>	Small pearls of 800 to 1,000 size.

“The pearls having been thus sized and classed, each class is weighed and recorded in *kaḷaṇṇchu* (kalungy) and *mañchāḍi* (manjaday).

“The *kaḷaṇṇchu* is a brass weight equal, it is said, to 67 grains Troy. The *mañchāḍi* is a small red berry¹⁰; each berry, when full sized, is of nearly, or exactly the same weight; they are reckoned at twenty to the *kaḷaṇṇchu*.

“The weights being ascertained, the valuation is then fixed to each pearl class or set of pearls according to the respective sizes and classes: the inferior qualities solely according to weight in *kaḷaṇṇchu* and *mañchāḍi*; the superior *āṇi*, *anātari*, and, *vaḍivu* are not valued only by weight, but at so much *per chevu* of their weight, this *chevu* being the native or pearl valuer’s

⁹ *Journal, Ceylon Branch, Royal Asiatic Society*, 1887, vol. X, No. 34. Paper read at the Conference Meeting of the Colonial and Indian Exhibition, October 6, 1886.

¹⁰ The seeds of *Abrus precatorius*, which are used in India for poisoning cattle.

mode of assigning the proper value by weight to a valuable article of small weight, form and colour also considered."

The pearls of commerce are, of course, for the most part those which are formed within the soft tissues of the animal, and not the irregular pearly excrescences (*oddumutta*) which are found as outgrowths of the nacreous layer of the shell, frequently at the point of insertion of the adductor muscle. The nacreous layer of the Gulf of Manaar pearl-oyster shell is very thin, and of small commercial value as compared with that of the pearl-oyster of Queensland and the Mergui Archipelago (*Avicula margaritifera*); and the shells, after the extraction of the pearls by the process of decomposition, are used mainly in the manufacture of chunám. The shells are, I believe, also exported to England from Ceylon for manufacture into buttons.

As regards the cause of the formation of pearls, concerning which many theories have been hazarded, the most prevalent idea being that they are a morbid secretion produced as the result of disease, I may quote from the excellent 'Guide to the Shell and Starfish Galleries in the British Museum (Natural History),' 1888, which tells us that "some small foreign body, which has accidentally penetrated under the mantle and irritates the animal, is covered with successive concentric layers of nacre, thus attaining sometimes, but rarely, the size of a small filbert. The nacre is generally of the well-known pearly-white colour, very rarely dark, and occasionally almost black.¹¹ The effort of the animal to get rid of the irritation caused by a foreign substance between its valves, by covering it over with nacre, and thus converting it into a pearl, is strikingly illustrated by two specimens in which, in the one case, an entire fish, and, in the other, a small crab has been so enclosed." According to Streeter¹² the nucleus of the pearl may be either a grain of sand, the frustule of a diatom, a minute parasite, or one of the ova of the oysters, thin layers of carbonate of lime being deposited around the object concentrically, like the successive skins of an onion, until it is encysted.

Writing in 1859¹³ as to what may be termed the worm theory of pearl formation, Dr. Kelaart stated that "Mon-

¹¹ Among the pearls from the samples lifted at Tuticorin in November 1888, there is one dumb-bell shaped specimen, of which one-half is white, the other dark brown.

¹² *Pearls and Pearling Life*, 1886.

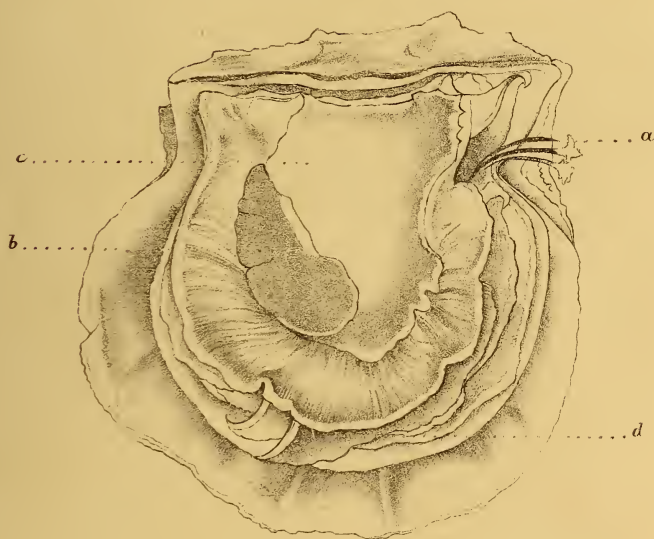
¹³ *Report on the Natural History of the Pearl Oyster of Ceylon*, 1858-59.

sieur Humbert, a Swiss zoologist, has, by his own observations at the last pearl fishery, corroborated all I have stated about the ovaria or genital glands and their contents, and he has discovered, in addition to the filaria and cercaria, three other parasitical worms infesting the viscera and other parts of the pearl oyster. We both agree that these worms play an important part in the formation of pearls, and it may yet be found possible to infect pearls in other beds with these worms, and thus increase the quantity of these gems. The nucleus of an American pearl drawn by Möbius is nearly of the same form as the cercaria found in the pearl oysters of Ceylon."

The Gulf of Manaar pearl oyster (*Avicula fucata*, Gould) is represented in plate I, as it appears after removal of one valve of the shell, the "ovarium," mantle, gills, adductor muscle and byssus being exposed.

Plates II and III, reproduced from drawings made from micro-photographs of sections of a pearl oyster from the Tuticorin banks, illustrate some of the points in the structure of the animal.

In plate II-2 and plate III-1, the byssus gland is shown with the parallel rows of laminae, to which are attached the numerous fine, green, silky filaments, of which the byssus is made up. This byssus is capable of being protruded beyond or retracted within the shell, and by means of it the animal is able to anchor itself on the sea-bottom, to a neighbouring oyster or other molluscan shell, coral-rock, melobesian nodule, or other convenient object, and it is said that the animal can, even in the adult stage, voluntarily shift its quarters and migrate to a considerable distance. That the young oyster can, during its phase of existence as a minute, free-swimming organism, wander about and eventually settle down on some congenial spot no one will dispute; but the evidence that the adult can, under natural conditions, migrate to any considerable distance is wholly insufficient, even though it has been demonstrated by experiments that a young pearl-oyster, under unnatural conditions in a soda-water tumbler full of sea-water can, though weighted with two other oysters of nearly its own size, climb up a smooth vertical surface at the rate of an inch in two minutes. The disappearance of about 150,000,000 oysters ripe for fishing from one of the Ceylon banks in 1888 must, I think, be attributed either to the action of a strong under-current which tore out the byssus from its gland, setting free the oysters from their moorings, or to one of those unknown



Lith. Gov^t School of art, Calcutta.

PEARL OYSTER:- ONE VALVE
OF THE SHELL REMOVED

Fig. I.



Fig. II.



Fig. I.

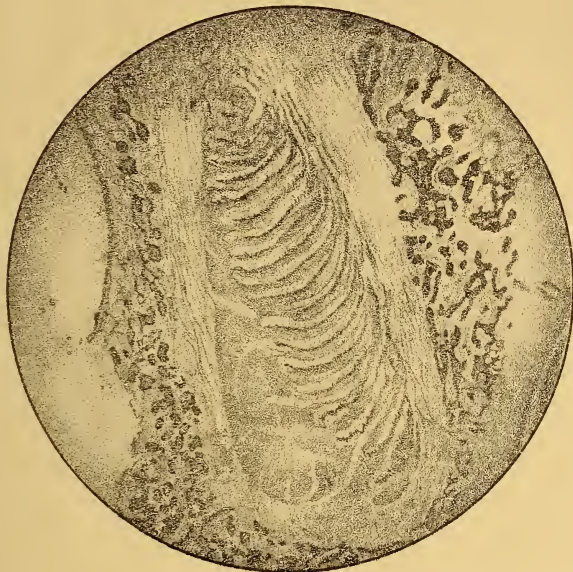
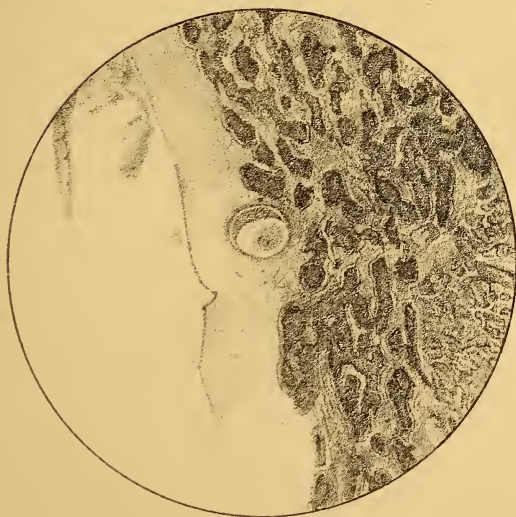


Fig. II



agencies by which gregarious animals, fishes, bivalve molluscs, &c., are occasionally known to be killed off wholesale and transported to a considerable distance. That the disappearance of the oysters was due to their voluntarily migrating, like snipe, seems improbable.

In plate II-1 the tissues which intervene between the alimentary canal and generative organs are seen to contain two parasites, which careful microscopical examination has shown to be undoubtedly larvæ of some platyhelminthian (flat-worm), the life history of which is unknown, and would require long and patient inquiry to ascertain. Similar parasites were found, on microscopical examination, to be very abundant in the alimentary canal, from which some of them must have bored their way, as ciliated larvæ, into the surrounding tissues, while others remained to develop within the alimentary canal. It is not improbable that these minute parasites may form in the tissues foci favourable to the laying down of layer after layer of nacreous deposit.

In plate III-2 an ovum is represented among the generative glands. This ovum was the only one found during the examination of a number of sections; and it has been suggested to me that it may be the ovum of the parasite referred to.

In September, 1890, I paid a hurried visit to Tuticorin in order to examine some living oysters, and the divers went out to the banks, and brought in a sample of about seventy oysters. The living animals I cut open by a vertical longitudinal section, and found, in a large majority of them, the genital duct occupied by a long, transparent, cylindrical, gelatinous body, which could be easily removed entire from the duct. Unfortunately I had no microscope with me, but a number of the tubes were placed in alcohol and submitted to microscopical examination on my return to Madras, small portions of the tubes being teased out on a slide and treated with various reagents. They were found to contain diatoms, and vast numbers of delicate sinuous bodies. In order to see if these bodies were possessed of motion, an attempt was made about a fortnight later to get some oysters alive in a tank of sea-water by train from Tuticorin to Madras. The hot railway journey, however, of nearly thirty hours proved fatal to them, though they were, on their arrival, sufficiently fresh for purposes of examination. The gelatinous bodies were now no longer present, and scrapings from the internal surface of the duct only revealed under the microscope,

*crystalline
oyster*

ciliated epithelium, leptothrix, &c. The conclusion which must, I think, be arrived at is that the sinuous bodies are the spermatozoa compacted by a gelatinous secretion into spermatophores, and are probably subsequently discharged from the genital duct for the direct or indirect fertilisation of another oyster.

The Tuticorin pearl fishery of 1889 was carried on from a temporary improvised village, erected on the barren sandy shore at Salápatturai, two miles north of the town, and built out of palmyra and bamboo, the inflammability of which was demonstrated on more than one occasion when the camp was, for a short time, in danger of being burnt to the ground. The village consisted of the divers' and merchants' quarters and bazárs, where, as the fishing progressed, the product of the oysters was exposed for sale; bungalows for the officials connected with the fishery; a tent used by myself as a marine zoological laboratory; dispensary; kottus or koddus (*i.e.*, enclosed spaces in which the counting, decomposition, and washing of the oysters are carried on); a Roman Catholic chapel; and the inevitable and highly necessary isolated cholera quarters.

The fishery commenced on the 25th of February under a combination of adverse conditions which seriously affected the revenue, viz., the fact that the pearl bank was at a distance of ten miles from the shore and in 10 fathoms of water, and the co-existence of a fishery on the Ceylon coast, where the oysters were to be obtained at a distance of about five miles from the shore and at a depth of five to seven fathoms. The natural result was that the natives, more keen as to their own interests than those of the Government, went off with their boats from the Madras seaport towns of Pámban and Kílakarai to the Ceylon fishery, where they could earn their money more easily and with less discomfort than at Tuticorin, leaving the Tuticorin bank to be fished by a meagre fleet of about forty boats.

An excellent account of the method of conducting the pearl fishery at Tuticorin has been published in the 'Hand-Book of Directions to the Ports in the Presidency of Madras and Ceylon,' 1878, from which the following varies only in points of detail.

The landwind, under favourable conditions, commences to blow soon after midnight, and a signal gun is fired by the beach master as a warning that the fleet of native boats, each with its complement of native divers, can start out to

sea. Their departure is accompanied by a good deal of noise and excitement. The bank should be reached by daylight, and the day's work commences on a signal being given from a schooner, which is moored on the bank throughout the fishery. An attempt is made to keep the boats together within an area marked out by buoys, so as to prevent the bank from being fished over in an irregular manner; and the temper of the European officer in charge of the schooner is sorely tried by the refusal of the boatmen to comply with the conditions. All being ready on board, a diving stone, weighing about thirty lbs., to which a rope is attached, and a basket or net fastened in a similar manner, are placed over the boat's side. The ropes are grasped by the diver (who wears no diving dress) in his left hand, and, placing a foot on the stone, he draws a deep breath, and closes his nostrils with his right hand, or with a metal nose clip which he wears suspended round his neck by a string. At a given signal the ropes are let go, and the diver soon reaches the bottom, his arrival there being indicated by the slackening of the rope. He then gets off the diving stone, which is drawn up to the surface, and, after filling the basket or net with oysters, if he is on a fertile spot, gives the rope a jerk, and comes up to the surface to regain his breath.

The contents of the basket or net are emptied into the boat, and the live oysters separated from the dead shells, débris, &c. The divers work in pairs, two to each stone, and the oysters which they bring up are kept separate from those of the other divers. A good diver will remain below the surface about fifty seconds, and, in exceptional cases, sixty, seventy, or even ninety seconds.

The largest number of oysters collected as the result of a single day's fishing by forty-one boats during my visit to the fishery was 241,000, giving an average of 5,878 oysters per boat; a very small quantity when compared with the results of the Ceylon fishery in 1857, when the daily yield varied from one to one and-a-half million oysters, some boats bringing loads of thirty to forty thousand.

From experiments made with divers equipped with diving helmets, gathering stones instead of oysters, by Mr. Thorowgood when Superintendent of the Madras Harbour Works, it was calculated¹⁴ that a pair of helmeted

¹⁴ *Vide* Madras Board of Revenue Resolution, No. 677, 3rd August, 1888.

divers could together send up 12,000 shells an hour in shallow water, or, allowing for delay in hauling up in 12 fathoms of water, say, 9,000 shells an hour ; and as, allowing for shifts, each diver should work four hours a day, the quantity sent up by a pair of divers in a day would be respectively $4 \times 12,000 = 48,000$, or $4 \times 9,000 = 36,000$ shells a day, which is equivalent to the work of 24 or 18 naked native divers sending up 2,000 shells a day.

The results of the work done by the two helmeted divers who were employed as an experiment at the Tuticorin fishery for some inexplicable reason fell far short of this estimate, and compared very unfavourably with the work done by the skilled native divers without helmets.

The diving operations cease for the day some time after noon, and the boats, if aided by a favourable sea breeze, reach the shore by 4 P.M., their arrival being awaited by large crowds of natives, some of whom come from curiosity, others to speculate on a small scale. On reaching the shore the boats are quickly made fast in the sand, and the oysters carried on the heads of the divers into the kottu, where they are divided into separate heaps, each set of divers dividing their day's haul into three equal portions. One of these, selected by the Superintendent of the fishery or some other official, becomes the property of the divers, who quickly remove their share from the kottu, and, squatting on the sand, put their oysters up for sale at prices varying from about fifteen to forty for a rupee. On the first day of the fishery the oysters, for a short and, to the divers, lucrative time, were sold for four annas a piece. The two heaps which are left by the divers in the kottu, become the property of Government, and are counted by coolies engaged for the purpose. Usually about 6 P.M. the Government oysters are sold by public auction, duly announced by tom-tom, and put up in lots of one thousand. The purchaser can, subject to the consent of the auctioneer, take a certain number of thousands at the same rate as his winning bid. Occasionally a combination is organised among the merchants who are buying on a large scale, and come to the auction determined not to bid more than a very small fixed sum per thousand. A struggle then takes place between the auctioneer and merchants, the former refusing to sell, the latter refusing to raise their price ; and the struggle invariably ends in the collapse of the merchants, when they find that their supply of oysters is cut off. No credit is allowed, and the buyers, as soon as they have paid their

money into the treasury, remove their oysters to the washing kottus, or send them away up-country by railway.

Buyers of oysters on a very small scale open them at once with a knife, and extract the pearls by searching about in the flesh of the animal ; but, by this method, a number of the very small pearls are missed, and it would be impossible to carry it out when dealing with oysters in large numbers. Boiling the oysters in water and subsequent extraction of the pearls from the dried residue might be, with advantage, resorted to as a more wholesome and less unsavoury process than the one which is resorted to of leaving the oysters to putrify in the sun, and subsequently extracting the pearls from the residue after it has been submitted to repeated washings to free it from the prevailing maggots, pulpy animal matter, sand, &c. The process of putrefaction is greatly aided by flies—big red-eyed blue-bottles. At the Ceylon pearl fishery, which I was sent to inspect on the termination of my work at Tuticorin, the merchants complained at first of the scarcity of flies ; but, later on, there was no cause for complaint, as they were present not only in the kottus, but in other parts of the camp, in such enormous numbers as to form a veritable plague, covering our clothes with a thick black mass, and rendering the taking of food and drink a difficult and unpleasant process until the evening, when they went to rest after twelve hours of unceasing activity.

To those who are in authority, a pearl fishery is a time of constant anxiety. The probabilities are delightful, but the possibilities are frightful. When all goes well a fishery is a time of money-making to all concerned, to the Government, the merchants, the divers and boatmen. But there is to those who are responsible the constant dread of epidemic disease—notably cholera—which may appear at any moment and ruin the expectation of a prosperous fishery. Such an invasion of cholera, bringing with it death and panic, I witnessed in 1889 at the Ceylon fishery, which collapsed entirely in consequence thereof, the camp being burned down and the fleet of nearly two hundred boats, with their panic-stricken crews, disappearing within the space of only a few hours.

The prospects of a pearl fishery may, when success seems certain, be abruptly ruined by accidents from sharks, of which the divers have a superstitious but not altogether unreasonable dread. Before the fishery of 1889, I read in the *Times of Ceylon*, that there were 150 boats, with their full

complement of men, all waiting at Kilakarai on the Madras coast in readiness to proceed to the scene of the fishery, after some festivities, which were to take place on a stated day, and at which prayers were to be offered for protection against the attacks of sharks. "The only precaution," Tennent writes,¹⁵ "to which the Ceylon diver devotedly resorts is the mystic ceremony of the shark-charmer, whose power is believed to be hereditary, nor is it supposed that the value of his incantations is at all dependent upon the religious faith professed by the operator, for the present head of the family happens to be a Roman Catholic. At the time of our visit this mysterious functionary was ill and unable to attend; but he sent an accredited substitute, who assured me that, although he was himself ignorant of the grand and mystic secret, the fact of his presence, as a representative of the higher authority, would be recognised and respected by the sharks." At the Tuticorin fishery in 1890 a scare was produced by a diver being bitten by a shark, but the scare subsided as soon as a "wise woman" was employed by the divers. Her powers do not, however, seem to have been great, for more cases of shark bite occurred, and the fishery had to be stopped in consequence at a time when favourable breezes, clear water, plenty of boats, and oysters selling at from Rs. 22 to Rs. 31 per thousand indicated a successful financial result.

As a means of keeping sharks off Captain Donnan, the superintendent of Ceylon pearl fisheries, took with him to the pearl banks in 1891 a number of specially-prepared cartridges, which he meant to try the effect of exploding daily under water in the event of sharks putting in an appearance. Before the commencement of the fishery, he exploded a cartridge suspended midway between the surface and the bottom to try the effect produced at a distance. The Government divers were down at the bottom at the time of the explosion at a distance of half to three quarters of a mile, and they said that the sound of the explosion was very distinct, and that they were satisfied that it would have frightened the sharks away.

Where, as in a pearl-fishing camp, a mass of uneducated men of strong passions and good physique, belonging to different countries and of different religious persuasions, is gathered together, it is not unnatural that serious conflicts should at times arise, which require the presence of a com-

¹⁵ *Ceylon*, 1860, vol. II, pp. 564-65.

petent police force, and prompt and judicious magisterial action. At the Ceylon fishery of 1890 the Government agent had to deal promptly with a disturbance in which the Arab divers were the aggressors. "Yesterday" writes the *Ceylon Observer*, "there was a wild scene. The 'Perseverance' started somewhat late for the banks. On her way out she picked up and took in tow several boats that were unable to get out. One of these contained Arab divers, and another which was being towed alongside contained Tamils. The Arabs wanted the Tamils to drop their boat astern to prevent the wash of the sea getting into their boat, but the Tamils very naturally refused. This was quite enough for the Arabs: ever ready for a row. They jumped into the Tamil boat and commenced to slack the rope. This was resented by the Tamils, and the result was a pitched battle, very warm while it lasted. The 'Perseverance' put back, picking up on her way some twelve or fourteen divers who had fallen or else been knocked into the water in the course of the fight. The Arabs were the smaller body in point of numbers, and got a thorough thrashing. One man had several of his front teeth knocked down his throat, while another had an eye knocked out, and probably, if the fight had occurred further out at sea, some of the men would have lost their lives."

For months after the conclusion of a pearl fishery poor natives may be seen hunting in the sand on the site of the pearl camp for pearls; and it is reported that in 1797 a common fellow, of the lowest class, thus got by accident the most valuable pearl seen that season, and sold it for a large sum.

The experiments of Sarasin and Fol showed that an electric light was distinctly seen at a depth of 33 metres, at 67 metres the clear image being replaced by a diffuse light faintly perceptible. Towards the latter end of 1888 it was suggested that an electric light apparatus should be acquired in connection with the pearl fishery, by means of which one would be able to examine the condition of the bank from the deck of a ship, and which, it was thought, would help to solve the enigmas that still hang about the migrations of the pearl-oyster. The notice of Government was drawn to the fact that a boat had been fitted up with a brush-dynamo and electric globe for the pearl fishery in South Australia by a Glasgow firm. During a short visit to Europe in 1888, I made a series of inquiries as to the possibility of obtaining a light, such as was required; but,

though there was abundant evidence as to the usefulness of the electric light for surface work, salvage operations, and scientific dredging,¹⁶ the general opinion of those best qualified to judge was that it would, for the proposed purpose, be a failure. It has been suggested by Mr. Phipps, who was for many years superintendent of the Tuticorin pearl banks, that, if a sheet of thick glass could be let into the lower plates of a vessel and there protected both outside and inside in some way from accident, a study of the sea-bottom in clear water, either by day with the sun's rays or by night by the use of a powerful electric light, might be made. In a letter to Government Mr. Fryer, Inspector of Fisheries, makes the sound suggestion "that the observations which the Government of Madras desire to make upon the habits of the pearl-oysters would be greatly facilitated by the employment of a diver equipped with an ordinary diving dress. By this means a prolonged stay could be made by an observer on the sea-bottom, who could not only make an accurate survey of the bed, but could periodically examine the same ground, select specimens, and make minute observations, which would be impossible to a native diver, whose stay at the bottom is limited to a minute or so." To these remarks I may add my own experience at the Tuticorin fishery, where, by examination of the shells of the oysters brought up by the divers, by expending small sums of money which tempted the native divers to bring me such marine animals as they met with at the sea-bottom, by conversation with the European diver, who was, further, able to bring up large coral blocks (*Porites*, *Madrepora*, *Hydnophora*, *Pocillopora*, *Turbinaria*, &c.) for examination, and by dredging, I was able to form some idea as to the conditions under which the pearl-oysters were living. On clear days it was possible to distinguish the sandy from the rocky patches by the effect of light and shade, and from hauls of the dredge over the former not only many mollusca, &c., but also specimens of *Branchiostoma*, sp.¹⁷ (Lancelet) were obtained, of which the largest measured two inches in length. Mollusca were also obtained in

¹⁶ Vide Herdman's *Second Annual Report on the Puffin Island Biological Station*.

¹⁷ Specimens of *Amphioxus belcheri*, Gray, were obtained by Mr. Giles when dredging from the Marine Survey SS. 'Investigator' off Seven Pagodas (Mahabalipuram) 30 miles south of Madras during the season 1887-88.

great variety by passing the débris, which was swept from the floor of the kottu every day after the oysters have been cleared away, through sieves. The big *Murex anguliferus* (elephant chank) was brought in from the banks by the divers nearly every day, and the animal served up for their hard-earned evening meal. The oysters shells were largely encrusted with bright-coloured sponges, of which the most conspicuous was *Clathria indica*, an erect-growing bright red species, recorded as a new species by Mr. Dendy in his report on my second collection of sponges from the Gulf of Manaar.¹⁸ Very abundant, too, was the large cup-shaped *Petrosia testudinaria*, of which a specimen in the Madras Museum measures 1·5 feet in height. Enveloping the oyster shells were tangled masses of marine algæ,¹⁹ and floating in dense masses on the surface was the Sargasso weed, *Sargassum vulgare*. The various minute living organisms entangled in the meshes of the algæ must serve as an efficient food-supply for the oysters. The outer surface of the living oyster shells was frequently covered with delicate bryozoa, which also flourished on the internal surface of the dead shells in the form of flat or arborescent colonies. In no single instance did I see an oyster shell from the Tuticorin bank encrusted with coral; whereas at the Ceylon fishery, and on the occasion of my subsequent inspection of the Ceylon pearl banks, I found the surface of a large number of the shells, both dead and living, covered, and frequently entirely hidden from view by delicate branching *Madrepora* or *Pocillopora*, or the more massive *Astræa*, *Cœloria*, *Hydnophora*, *Galaxea*, &c. A specimen of *Galaxea* encrusting a single valve of an oyster shell, which I picked up on the shore and is now in the Madras Museum, weighed as much as 5 oz. 15 dwts.

Several species of echinoderm, which had not previously been recorded from the coast of the Madras Presidency,²⁰ were brought up by the divers, and were identified by my friend Professor Jeffrey Bell. Of recorded species those which were brought on shore most frequently were the crimson-lake coloured *Oreaster lincki*, and the long-armed, usually salmon-coloured *Linckia lævigata*, and, not

¹⁸ *Ann. Mag., Nat. Hist.*, Feb. 1889.

¹⁹ The collection of algæ made at Tuticorin has been sent to Mr. G. Murray, of the British Museum (Nat. History) for identification.

²⁰ Vide *Proc., Zool. Soc., Lond.*, June 19, 1888.

unfrequently, dense clusters of *Antedon palmata* were found in crevices hollowed out in coral blocks, from which also, when broken open, specimens of ophiuroids (commonly met with their arms turned round the branches of a *Gorgonia*, or in the canal system of sponges), chætopods, crustaceans, and stone-boring mollusca (*Lithodomus*, *Parapholas*, *Venerupis*, &c.) were obtained.

II.—CEYLON PEARL FISHERY, 1889.

ON the completion of my investigations at the Tuticorin pearl fishery in 1889, I proceeded, in compliance with instructions received from the Madras Government to Ceylon, to report on the pearl fishery which was being carried out on the Muttuwartu par (or bank) off Dutch Bay.

It was originally intended that I should travel up the coast by S.S. 'Active'; but, as she was laden with stores for the pearl camp, there was no available space, and I had, unfortunately, to wait for a passage on the small coasting steamer 'Prince Alfred', which left Colombo two days later. As we neared Dutch Bay, on the shore of which the pearl camp was located, in the early morning, the familiar odour of decomposing oysters was perceptible some distance out at sea, and we watched a few boats at work on the pearl bank. Arrived at the camp, I found Mr. Twynham, the Government Agent, Captain Donnan (whose name is connected with a Gulf of Manaar sponge, *Axinella donnani*), and other administrative officers living on board the schooner 'Serendib' moored close to the shore, communication with which was maintained by means of a gangway. Several deaths from cholera occurred on board during the return journey of the 'Serendib' to Colombo, and, among others Captain Robson, who had acted as kottu superintendent throughout the fishery, fell a victim to the dread disease.

The few boats, which had been at work on the bank, were towed into the bay by the 'Active', reaching the shore opposite the kottus before 4 P.M. I gathered that the steamer had been of very great service during the fishery; for, with her assistance, not only were the boats enabled to get to and from the bank in spite of contrary winds, but the work of the divers, which is very severe, was considerably lightened by the simple fact that the steamer could bring them back at an early hour on days when, without her assistance, they would have been out at sea until late in the evening, and not inclined to start off for the bank on the following morning.

Fortunately I examined the oysters which were brought in by the boats; for, as events turned out, it was my solitary

opportunity of making an examination thereof. I was at once struck with the fact that the shells of the oysters presented an entirely different appearance to those of the Thalayiram par (Tuticorin); for, whereas the latter were enveloped in dense masses of algæ (sea weeds) and the surface of the shells was covered by variously colored branching and sessile encrusting sponges, the surface of the shells of the former which was uppermost during life was, in very many cases, covered over by young stony corals, which, according to the species, formed either encrusting masses or branching tufts. A series of specimens of the shells, with the attached corals, many of which were to be seen lying strewn along the sandy shores of the bay, discarded by natives after extraction of their contents, has been deposited in the Madras Museum, where they form a very attractive exhibit. Further examination of these coral-bearing shells at various ages would be of interest; for, as the age of the oysters can be approximately fixed, a very good idea could be obtained, by weighing and by observation of the size of the corals on oysters of different ages, as to the rate at which the corals grow.¹ Chemical analyses of the sea water over the Ceylon and Tuticorin pearl banks, especially with reference to the percentage of lime salts, should also be carried out. In connection with my observation that the Tuticorin shells were covered with algæ while the Ceylon shells were encrusted by corals, a Ceylon correspondent wrote as follows:—"From the fishery of 1887 we took away specimens, very beautiful to look at, but several of which showed that the unfortunate animals inhabiting the shells had their residences converted into their tombs by the fatal industry of the coral animals. But our specimens were not obtained from the Modaragam par, which was that we saw fished, and the shells taken from which are always covered with red-colored algæ, and never with corals. We gathered our coral-covered specimens from the mounds of dried shells on the sea-shore, and learned that they had been taken in a previous fishery from another bank."

The mid-day heat at Dutch Bay was very intense; the sand became so hot that even horny-soled coolies could not walk on it; and the blue-bottle flies were an intolerable pest from early morn till sun down. The plague of flies at the Ceylon fisheries has occurred on former occasions, and

¹ The rate of growth of corals is fully discussed in Darwin's *Structure and Distribution of Coral Reefs*, 3rd ed., 1889.

Mr. G. Vane, who conducted the fisheries from 1855-60, rites as follows :—

“Then come flies, innumerable, of the largest kind ; indeed flies are constant plagues, but are worse with a southerly wind, everything being covered with a black mass ; a glass of wine or water must be drunk as poured out, or it is filled with flies, but southerly winds do not last long, and it seems as though providentially arranged that the prevailing winds should aid the purposes and needs of a pearl fishery.”

Early in the morning of the day following my arrival at Dutch Bay my suspicion over-night that all was not well was confirmed by the receipt of information that deaths from cholera had occurred in camp, and that there was a panic among the divers, who had struck work. It was promptly decided to abandon the fishery, and permission was given for the boats to leave. The divers' quarters and sale kottus (the fences of which had begun to throw out leaves) were, as a matter of precaution, burned down, and by 4 P.M. most of the boats were out at sea, many making for the Madras coast and carrying thither the epidemic disease.

The general arrangement of the Dutch Bay camp corresponded, in all essential particulars, with the arrangement of the Tuticorin camp. The latter is, in fact, based on what I may term the Ceylon type.

The camp is described by a newspaper correspondent in the following words² :—“What was only the other day a sandy desert is now a populous and thriving town, with rows of buildings and well-planned streets. The two principal streets run parallel to each other. Each is about a mile long and 120 feet wide. These are again intersected by cross roads at intervals of 200 feet, an arrangement which permits of free ventilation, &c. Along the centre of each principal street there is a row of wells and lamps That portion of the town described above is situated at the south end of Dutch Bay, and is occupied by merchants, boutique-keepers, divers, *et hoc genus omne*. To the west of this, where the buildings are of a superior order and more apart from each other, we have the custom-house, court-house, police station with the Union Jack flying gaily in front of it, the Government Auditor's quarters, the doctor's buildings, the general hospital, out-door dispensary,

² *Ceylon Observer*, 2nd March, 1889.

rest-houses, &c. On the spit of sand (a sand bank) are built the Government and private kottus and the sale bungalow. Here, too, are the head-quarters of the police . . . By the side of this spit of land, and closely moored to it, are the *Dib*, the *Antelope*, and the *Sultan Iskander* which serve as quarters of the Government Auditor, Captain Donnan, and their subordinate officers. Far away from this site and at the very end of the spit can be described some of a dozen yellow flags, which are said to indicate the situation of the quarantine station and the hospitals for cholera and small-pox patients. . . . Somewhere about the commencement of the spit stands a dilapidated Roman Catholic church, sea-eaten and falling into ruins. Father Dineaux, who is temporarily in charge, tells me that his church is in imminent danger of total disappearance owing to encroachments from the sea like the proverbial building that was built on the sands. The cemetery which belonged to this church and formed part of its grounds has long since been claimed by the sea, and those who were once buried in terra firma now sleep beneath the wave."

A small guard steamer was employed in cruising about the bay during the fishery, so as to prevent the divers, on their return from the bank, from dropping bags of oysters in the shallow water, which could afterwards be picked up. This form of fraud—and the frauds perpetrated by pearl divers are many—was scarcely possible at Tuticorin, where the boats arrived on shore opposite the kottu straight from the open sea.

Good fresh water was obtained from shallow wells dug in the sandy shore, and there was an abundance of water, condensed by the '*Serendib*,' in a large tank; but the condensed water did not seem to be appreciated by the natives.

I had, unfortunately, no opportunity of watching the process of counting the oysters in the kottu, or the management of an auction on a large scale; but, so far as I could gather from the counting and sale of the oysters brought in by the few boats already referred to, the system was the same as that adopted at Tuticorin.

Turning now to a comparison of the Tuticorin and Dutch Bay fisheries in 1889, the latter had the advantages of—

- i. a large fleet (193) of boats, and a correspondingly large staff of divers;

- ii. the presence of an efficient steam-tug throughout the fishery, by means of which both time and labour were saved;
- iii. the existence of the oysters in comparatively shallow water and near to land.

The Tuticorin fishery laboured, on the other hand, under the disadvantages of—

- i. a very small fleet (44) of boats, and small staff of divers;
- ii. the absence of a tug for a long time after the commencement of the fishery;
- iii. the existence of the oysters in deeper water, and at a great distance from the shore than at Dutch Bay.

And there was, if the health of the camp is left out of the question, no compensatory advantage at Tuticorin.

The following table shows the results of the Ceylon fishery from the date of its commencement up to March the 27th :—

Date.	Number of boats.	Total number of oysters fished.	Sold for Government.	Average rate per 1,000.	Revenue.
				RS.	RS.
2nd March	89	542,527	361,685	28	10,133·87
4th "	170	1,030,342	686,895	22	14,340·80
5th "	...	1,183,455	788,970	28·79	22,718·10
6th "	191	1,343,415	895,610	26·19	23,461·47
7th "	188	1,611,616	1,074,410	20·00	21,488·20
8th "	...	1,357,365	904,910	20·05	18,143·11
9th "	190	1,432,717	955,145	21·96	20,983·19
11th "	193	1,623,750	1,082,500	20·17	21,834·00
12th "	191	1,688,430	1,125,620	15·01	16,909·30
13th "	190	1,599,045	1,066,030	15·00	15,990·45
14th "	190	1,803,240	1,202,160	16·44	19,769·56
15th "	187	1,926,000	1,284,000	19·04	24,453·00
16th "	190	2,209,688	1,473,125	21·63	31,868·75
18th "	191	1,992,847	1,328,565	19·31	25,656·30
19th "	189	2,439,802	1,626,535	15·95	25,956·03
20th "	188	1,946,250	1,297,500	15·00	19,462·50
21st "	190	2,238,998	1,492,665	19·95	29,781·63
22nd "	189	2,215,725	1,477,150	22·55	33,320·15
23rd "	187	2,372,003	1,581,335	18·36	29,035·70
25th "	187	...	1,325,875	15	19,888·13
26th "	...	...	1,099,070	17	17,730·12
27th "	...	...	1,052,045	17	18,918·86

The total quantity of the Government share of oysters, was, therefore, 25,134,015, and the total sum realised as the result of 22 days' fishing Rs. 4,81,887-52.

Comparing these results with those of the Tuticorin fishery, the following table shows the results obtained at the latter during the time of the Dutch Bay fishery, viz., from 2nd March to 27th March :—

Date.	Num- ber of boats.	Total number of oysters.	Euro- pean diver.	Bom- bay diver.	Sold for Govern- ment.	Rate per 1,000.	Revenue.
						Rs. A. P.	Rs. A. P.
2nd March ...	3	6,000	...	...	4,000	43 0 0	172 0 0
4th " ...	...	...	...	...	...	...	...
5th " ...	38	151,500	...	...	101,000	25 6 4	2,565 0 0
6th " ...	38	180,000	...	...	120,000	25 13 2	3,099 0 0
7th " ...	40	180,000	...	...	120,000	24 14 3	2,987 0 0
8th " ...	41	187,333	254	80	125,000	26 1 5	3,261 0 0
9th " ...	42	224,654	130	562	150,000	25 6 8	3,813 0 0
11th " ...	44	204,907	592	594	137,000	22 10 3	3,102 0 0
12th " ...	42	235,121	643	115	157,000	21 0 4	3,301 0 0
13th " ...	44	235,917	1,405	760	158,000	21 3 2	3,350 0 0
14th " ...	37	148,280	439	...	99,000	21 8 5	2,131 0 0
15th " ...	35	158,905	190	...	106,000	20 10 8	2,191 0 0
16th " ...	44	213,809	2,000	2,381	144,000	21 2 6	3,067 0 0
18th " ...	...	...	...	...	...	...	...
19th " ...	24	97,450	99	...	65,000	26 10 1	1,731 0 0
20th " ...	12	82,500	...	...	55,000	26 13 4	1,476 0 0
21st " ...	43	360,572	966	890	241,000	22 2 7	5,341 0 0
22nd " ...	44	292,473	1,452	1,602	196,000	21 12 9	4,274 0 0
23rd " ...	35	244,500	...	...	163,000	22 5 7	3,643 0 0
25th " ...	...	...	...	...	...	...	...
26th " ...	2	4,565	3,070	1,000	4,400	30 5 0	133 6 5
27th " ...	44	379,025	950	...	253,000	24 10 2	6,234 0 0

The total quantity of the Government share of oysters, was, therefore, 2,398,400, and the total sum realized during the time under notice Rs. 55,871-6-5.

A comparison of these two tables is very instructive, and brings out very clearly the fact that, whereas in Ceylon the fishery was carried on without interruption (no fishery took place either in Ceylon or at Tuticorin on Sunday the 3rd, 10th, 17th and 24th), and, after the first few days, during which time all the boats had not arrived, or were not ready for work, a large and uniform number of boats were at work daily and regularly bringing in good loads of oysters; at Tuticorin, on the other hand, not only was there no fishery at all on three days (exclusive of Sundays), but on different occasions, out of the entire fleet of 44 boats, as few as 2, 3, and 12 boats were at work, with the result that, during 6 out of the 22 working days under review, only 63,400 oysters, yielding Rs. 1,781-6-5, fell to the Government share, i.e., the total yield of six days was less than that

which was, with one exception, the 19th, obtained as the result of a single day's work.

In view to the possibility of clashing of the fisheries in future years, a mutual agreement, relating to the division of the pearl fishery season between the Ceylon and Tuticorin pearl banks, has been come to between the Madras and Ceylon Governments; and the proposal of the Madras Government that the Ceylon fisheries should begin in February and close at the end of March, leaving April and May for the Tuticorin fisheries, met the wishes of the Government of Ceylon.

A steamer has recently (1893) been acquired by the Madras Government, which will be of infinite service on the occasion of future pearl fisheries, and for carrying out systematic annual and periodical inspections of the pearl banks.

III.—INSPECTION OF CEYLON PEARL BANKS.

HAVING received permission from Sir Arthur Gordon, K.C.M.G., Governor of Ceylon, to accompany Captain Donnan, Inspector of the Ceylon pearl banks, on his annual inspection cruise, I left Madras for Colombo by S.S. 'Rewa' on the 3rd October, 1889, taking with me some young plants of *Victoria regia*, reared in the nursery of the Madras Agricultural Society, for planting in the tank of the new Fort Gardens at Colombo, where they subsequently flowered.

While in Colombo I took the opportunity of examining the excellently preserved specimen of *Rhinodon typicus* in the Ceylon Government Museum for the sake of comparison with the specimen (plate III-A), 22 feet in length from the end of the snout to the extremity of the tail, which was cast on shore at Madras in February, 1889, when I was unfortunately far away from head-quarters, so that the chance was missed of examining its stomach contents and internal anatomy. The telegram which reached me announcing the arrival of the monster ran as follows:—"Whale on shore. Stupendous spectacle." But, on the following day, I learnt, from the evidence of an expert, that the whale was a shark. As the following extract shows, but few specimens of this gigantic elasmobranch have been recorded:¹—

"For many years the sole evidence of its existence rested upon a stray specimen, 15 feet in length, which was brought ashore in Table Bay during the month of April 1828, and fortunately fell into the hands of the late Sir Andrew Smith, then resident in Capetown, who named, described, and figured it. The specimen itself was preserved by a French taxidermist, who sold it to the Paris Museum, where it still remains in a much deteriorated condition. Forty years later—in 1868—Dr. Percival Wright, whilst staying at Mahé with Mr. Swinburne Ward, then Civil Commissioner of the Seychelles, met with this shark,

¹ In his *Account of the Pearl Fisheries, of Ceylon*, Captain Steuart records having seen on one occasion "a spotted shark of almost fearful size; it was accompanied by several common sized sharks, and they appeared like pilot fish by its side."



CALCUTTA PHOTOTYPE CO.

RHINODON TYPICUS.

and obtained the first authentic information about it. It does not seem to be rare in this Archipelago, but is very seldom obtained on account of its large size and the difficulties attending its capture. Dr. Wright saw specimens which exceeded 50 feet in length, and one that was actually measured by Mr. Ward proved to be more than 45 feet long. Nothing more was heard of the creature until January, 1878, in which year the capture of another specimen was reported from the Peruvian coast near Callao. Finally, in the present century, Mr. Haly, the accomplished Director of the Colombo Museum, discovered it on the west coast of Ceylon, and succeeded in obtaining two or three specimens.² One of these was presented by that institution to the Trustees of the British Museum, and, having been mounted by Mr. Gerrard, it is now exhibited in the fish gallery, where it forms one of the most striking objects, although it must be considered a young example, measuring only 17 feet from the end of the snout to the extremity of the tail.

"A true shark in every respect, *Rhinodon* is distinguished from the other members of the tribe by the peculiar shape of the head, which is of large size and great breadth, the mouth being quite in front of the snout, and not at the lower side, as in other sharks. Each jaw is armed with a band of teeth arranged in regular transverse rows, and so minute that, in the present specimen (Ceylon), their number has been calculated to be about 6,000. The gill openings are very wide; and three raised folds of the skin run along each side of the body. Also in its variegated coloration this fish differs from the majority of sharks, being prettily ornamented all over with spots and stripes of a buff tint."

The following measurements of the Madras specimen were made by my friend Dr. A. G. Bourne when the fish was lying on the beach:—

	INCHES.
Total length 22 feet or	264
Root of 1st dorsal (fin) to upper jaw ...	118
Anterior edge of 1st dorsal ...	22
Base of 1st dorsal	24
Distance between 1st and 2nd dorsal ...	27
Anterior edge of 2nd dorsal	11½

² In April, 1890, a further specimen of *Rhinodon*, 14 feet 6 inches in length was caught off Bambalapitiya (Ceylon).

INCHES.					
Base of 2nd dorsal	...	...	...	10	$\frac{1}{2}$
Length of upper caudal lobe	...	...	...	60	
„ of lower do.	...	...	...	30	
Anterior edge of pectoral fin	...	...	...	38	
First branchia to anterior edge of pectoral fin	...	...	...	15	
Breadth of pectoral fin at base	...	...	...	20	
Length of 1st gill opening	...	...	...	23	
„ of 2nd do.	...	...	...	23	$\frac{1}{2}$
„ of 3rd do.	...	...	...	21	
„ of 4th do.	...	...	...	20	
„ of 5th do.	...	...	...	17	
Eye diameter	...	...	...	1	$\frac{1}{2}$
Spiracle	...	...	...	$\frac{3}{8}$ inch	by 1
Mouth	...	...	...	30	
Teeth, lower jaw	...	...	...	(14 rows)	
Top of snout to 1st branchia	...	...	...	40	
Tip of snout to eye	...	...	...	10	
Eye to spiracle	...	...	...	4	

After waiting for several days on the chance of a moderation of the prevailing south-west wind, I left Colombo with Captain Donnan on the barque 'Sultan Iskander,' which towed after her the diving boats, each with its crew composed of coxswain, rowers, divers, and munducks (who attend to the divers, letting them down by ropes, pulling them up, &c.). The crew made the schooner almost unbearable by cooking for their evening meal putrid fish, which in smell rivalled the well-known *gnapè* of Burma. As an inspection of a reported pearl bank off Negombo was out of the question owing to the heavy swell, we sailed straight on to Dutch Bay, where we anchored, after a somewhat boisterous passage, on the following morning, inside the long and rapidly extending spit of sand, which forms the western boundary of the bay, on which the sale bungalow, kottus, &c., were standing during my last visit in March at the time of the collapse of the pearl fishery from cholera. The Bay now presented a very deserted appearance. The sandy shore was crowded with hosts of wading birds, and the sole human occupants were a few fishermen and a number of natives, from near and distant parts of the island, engaged in searching for stray pearls in the sand formerly occupied by the washing kottus, the site of which was indicated by the remains of the fences and heaped up

piles of oyster shells, and gaining as the reward of their labour from one to two rupees a day. It was reported that one woman had found five pearls, each of the size of an ordinary pepper pod, for which she had been offered and refused 150 rupees. The seaward face of the sand-spit was strewn with coral fragments rolled in by the waves from the reef, which intervenes between the shore and the pearl bank, and is partially laid bare at low tide; and the sand was riddled with the burrows of a very large oecypod (*O. platytarsis*), the carapace of a male of which species captured by me after an exciting chase measured 56 mm. in length and 66 mm. in breadth. If one of these crabs is killed and left on the shore, its cannibal fellow creatures carry it away into a burrow, and, doubtless, devour it.

On the day after our arrival at Dutch Bay we sailed in one of the diving boats to Karaitivu and Ipantivu islands and the mainland in search of a possible spot adapted for the requirements of a pearl camp at the next fishery. In the shallow water near the shore of Karaitivu island fishes—*Mugil* and *Hemiramphus*—some of which leaped into the boat and were eventually cooked, fell easy victims to fishing eagles and gulls. Two hauls of the dredge in the sand and mud brought up *Amphioxus*, *Lituaria phalloides*, the Trepang *Holothuria marmorata*, *Astropecten hemprichii*, *Philyra scabriuscula*, *Chloeia flava*, and many molluscs; a large number of the species of mollusc, both here and in Dutch Bay, being common to the Indian and Ceylon Coasts of the Gulf of Manaar. On the mainland forming the eastern boundary of Dutch Bay, into which the river Kala Oya discharges its water by several mouths, dense jungle and swampy ground teeming with the mollusc *Pyræzus palustris* reach right down to the water's edge; and, as we walked along the shore, we came across solid evidence of the recent presence of elephants. We were told by a native that bears and wild pigs are so thick in the jungle that one trips over them as one walks along!

In 1868 large numbers of young pearl-oysters are reported to have been spread over a considerable extent of the muddy bottom of Dutch Bay in from one to two fathoms of water, but the situation was, evidently, not favourable for their healthy growth.

The weather being unfavourable for the work of inspecting, we had to remain unwilling prisoners in Dutch Bay, the days being spent in cruising about, and dredging in the shallow water. But on the 29th, as the wind had changed

and the sea abated, we made a start for the neighbouring pearl bank—Muttuwartu par—to which we were towed by the 'Active.' As soon as we had anchored on the south end of the bank, a diver was sent down from the ship's side in $6\frac{3}{4}$ fathoms, and brought up his rope basket containing plenty of healthy, living oysters, which, he reported, came away easily from the rock to which they were attached by their byssi.³ At the fishery in March the divers complained of the difficulty in detaching the oysters; and the degree of ease with which they can be gathered is considered a sign of their ripeness for fishing, the byssus being said to begin after the fifth year to break away from the substance to which it adheres tightly during the early life of the oysters.

The excellent plan which is employed in the inspection of the Ceylon banks, and by which a thorough knowledge of the condition of the banks as regards the oyster supply is obtained, is the same in principle as that adopted by searchers for lapwing's eggs in England. The inspection barque is anchored in a position fixed on the chart by bearings from the shore. The steam tug, towing a boat with buoys bearing flags on board, first lays out buoys in the north, south, east, and west at distances of $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ of a mile from the barque. Buoys are then laid out at a distance of $\frac{3}{4}$ of a mile from the barque in the north-east, north-west, south-east, and south-west. Four diving boats, each with a coxswain in charge, five rowers, three divers, and two munducks, are arranged in line between the north $\frac{1}{4}$ mile buoy and the barque, the distance being equally divided between the boats. The rowers work round in a circle, and the divers make frequent dives in search of oysters until the starting point is reached. The boats are then again arranged in position, and the circle between the $\frac{1}{4}$ and $\frac{1}{2}$ mile buoys is explored. Lastly, the third circle, between the $\frac{1}{2}$ and $\frac{3}{4}$ mile buoys, is, in like manner, explored; so that, when this circle is completed, each boat has described three circles with the inspection barque as a centre. And, in this way, twelve circles in all are described by the four boats. The oysters are then brought to the ship, counted, and put in sacks daily, until a sufficient number (15,000) to form a sample for washing and valuation by experts has been col-

³ "The term rock is applied to pieces of coral, living or dead, averaging about a foot in diameter, which are scattered more or less thickly over certain parts of the banks.

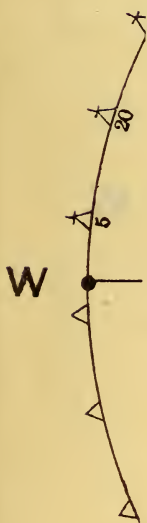
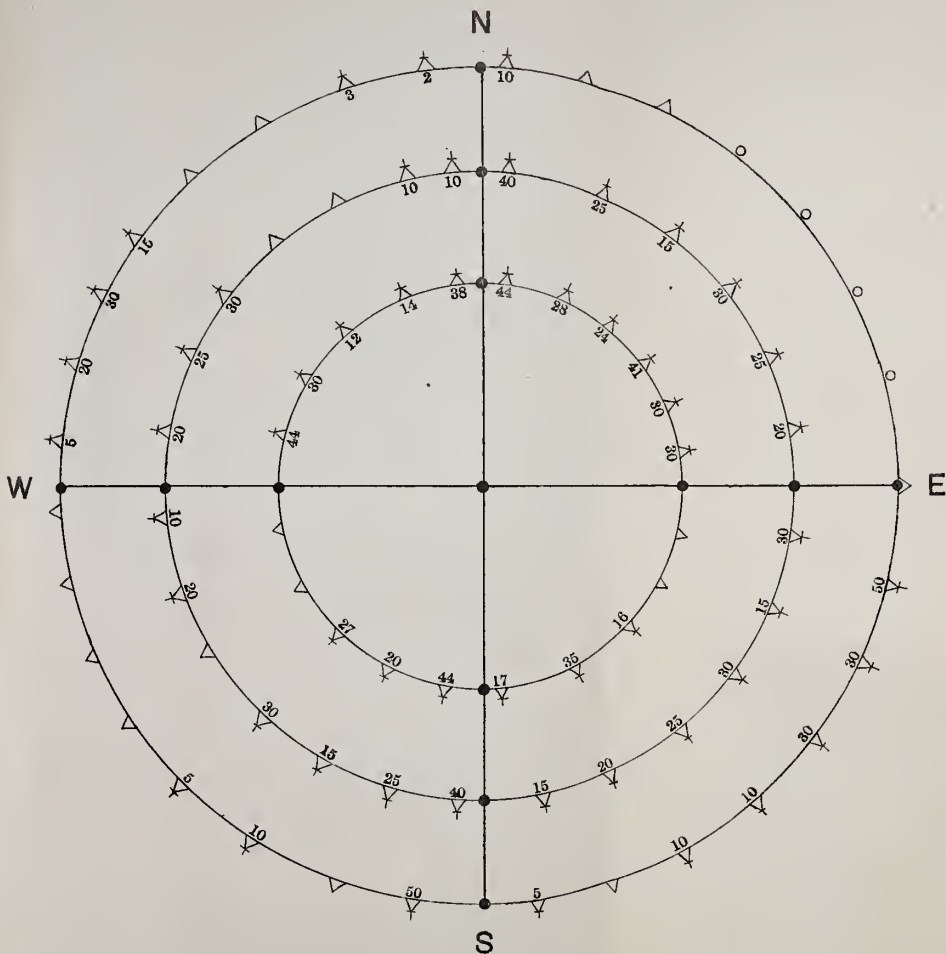


DIAGRAM. A

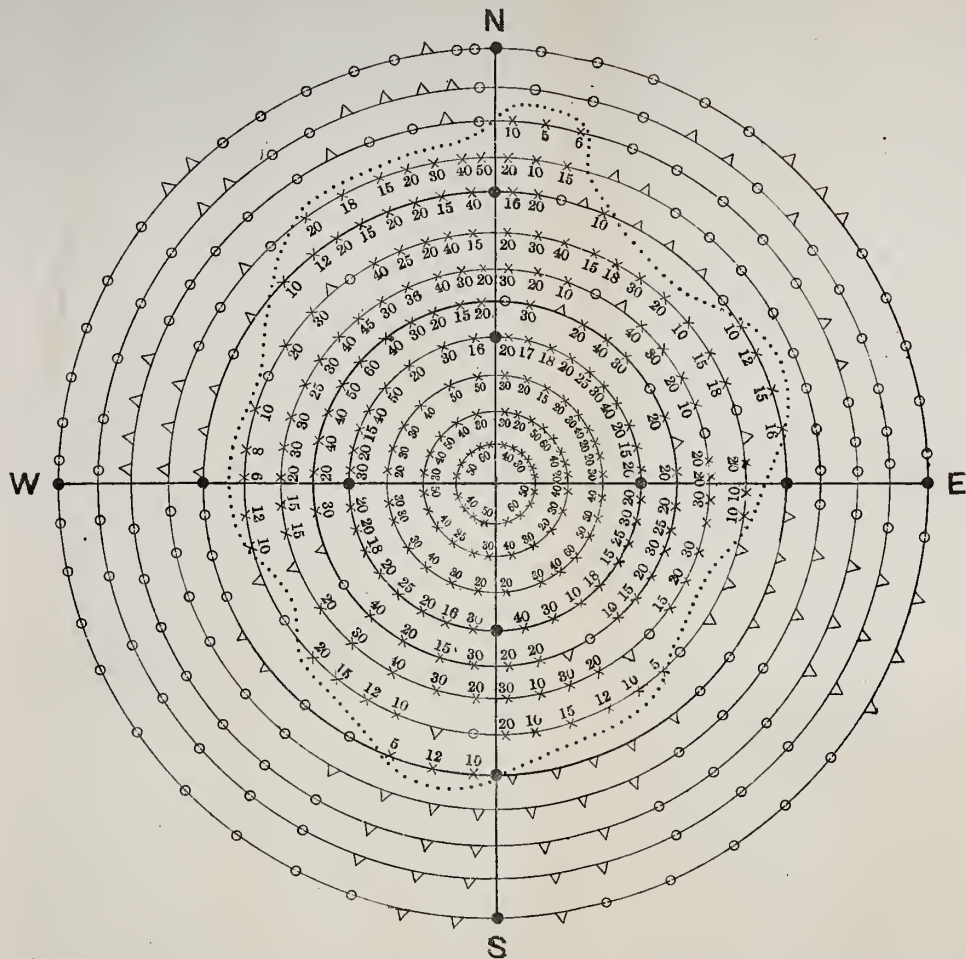




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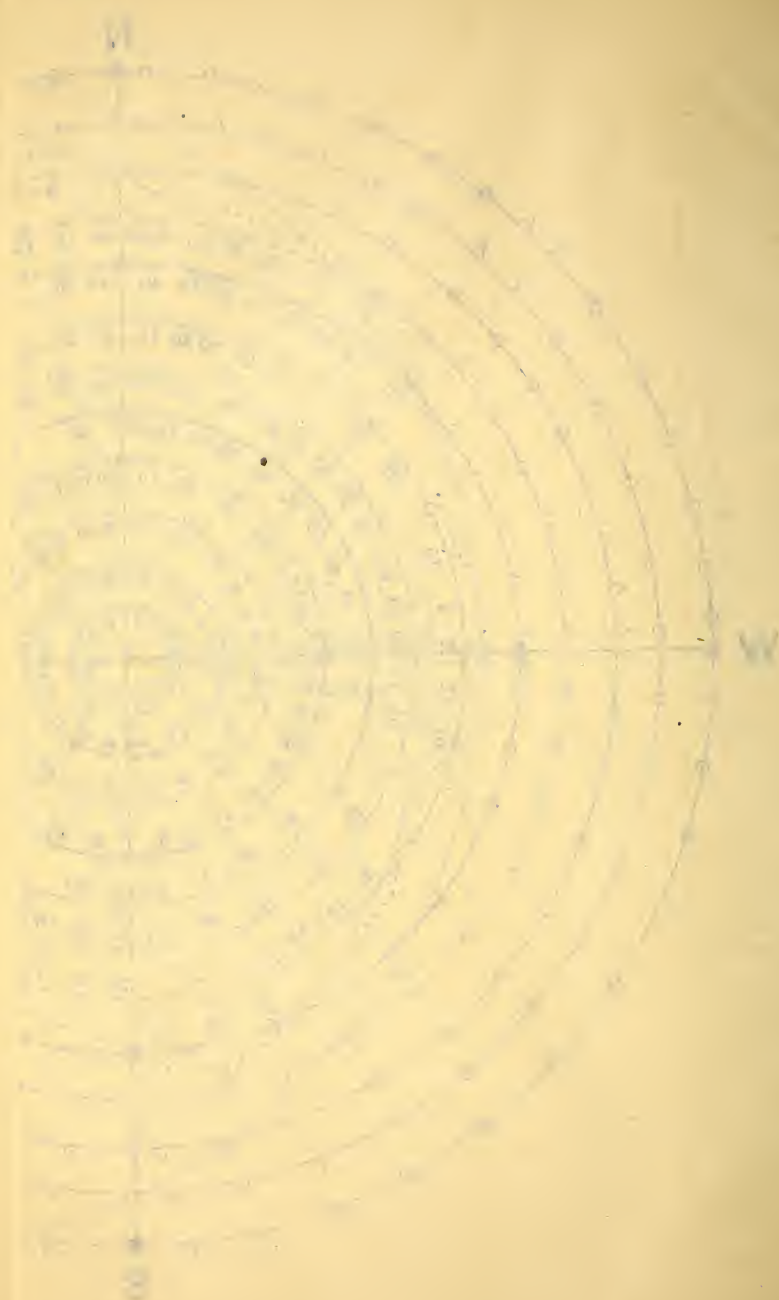


DIAGRAM. B



Zinco., Survey, Office, Madras.

1894



lected.⁴ The coxswain of each boat records on a diagram, provided by the Inspector, the approximate position of each dive which is made, the nature of the bottom (a triangle = rock, a circle = sand, and a cross = oysters), and the number of oysters lifted. Diagram A represents the day's work done by a single boat over ground which, with the exception of a sandy patch between the north and east $\frac{3}{4}$ mile buoys, was rocky, and on which oysters were plentiful except over a portion of the outer circle. Diagram B, made up from the four coxswains' reports, represents a single day's work done by all the boats, and shows the distribution of the oysters over the area inspected, and the limits of the bank. As soon as the buoys have been taken up by the tug, the inspection barque is moved to a new position $1\frac{1}{2}$ mile distant from its former one, and the buoys are again laid out in circles; to act as guides to the boats in the next day's work. Without the assistance of the buoys the boats would not be able to describe separate circles, but would work in an irregular manner, and two or more boats would, very probably, go over the same ground. But, with the assistance of the buoys, the whole bank can be systematically surveyed.

The Muttuwartu par, which was fished in the spring of 1889, is situated about five miles from the seaward shore of Dutch Bay, and covers an approximate area of $3 \times 1\frac{1}{2}$ miles, the depth of water over the bank ranging from 5 to 10 fathoms with an average of about 7 fathoms. The temperature of the water at the bottom, registered with a Negretti and Zambra's deep-sea thermometer, varied from 80° to 82° between 8 A.M. and 5 P.M. Between the bank and the shore is a coral reef, the presence of which was indicated by the waves breaking over its outer face amid a prevailing calm, and by gulls resting on the coral blocks. The most conspicuous madreporaria on this reef, which is surrounded by $4\frac{1}{2}$ to 5 fathoms of water, belong to the genera *Madrepora* and *Pocillopora*, while *Galaxea* and *Leptoria* are present in less abundance. The bright white patches of sand, which cover large spaces between the coral growths, teem with protozoa and a calcareous alga, and are more rich in delicate molluscs than any other deposit which I have examined in the Gulf of Manaar. Sheltered among the coral tufts were sluggish holothurians and hosts of small crustaceans; and, clinging to the branches of a madrepo-

⁴ If a young bank is being inspected, samples are brought up by the divers, but they are not washed for valuation.

I found a single specimen of the quaint crustacean, *Thenus orientalis*.

Outside the seaward face of the pearl banks on the Indian coast of the Gulf of Manaar the depth of the sea increases very gradually, so that, for example, outside the Tholayiram par, a depth of only 15 to 20 fathoms is reached at a distance of 3 miles. Outside the Muttuwartu par, however, the area of shallow water ceases very abruptly, and the depth increases rapidly to 150 fathoms at a distance of three-quarters of a mile from the seaward face of the bank, where the following temperatures were recorded (in the month of November):—

Surface	.. 83°	60 fathoms	.. 68°
10 fathoms	.. 81°	100 „	.. 61°
20 „	.. 80°	150 „	.. 55°
30 „	.. 72°		

On the 19th March, 1890, the temperatures recorded by Captain Donnan 4 miles west of the Muttuwartu par were:—

Surface	.. 85°	100 fathoms	.. 59°
30 fathoms	.. 81°	150 „	.. 54°
60 „	.. 68°	200 „	.. 52°

Several hauls of the dredge brought up *Polytrema cylindricum*, *Gorgonice*, *Heteropsammia cochlea*, *Cirrhopathes spiralis*, *Spongodes* sp., *Fibularia ovulum*, &c., but no pearl oysters.

The divers received instructions to keep apart for me everything, other than oysters, which they came across during their day's work, under the general heading of corals, shells, *poochees*, and weeds; and, by examination of the specimens which they reserved and going rapidly over the oysters, I was enabled not only to make a rich collection, but also to ascertain roughly in what respects the fauna of this portion of the west coast of Ceylon differs from that of the Indian coast of the Gulf of Manaar. The first day's inspection of the Muttuwartu par showed not only that the oysters were very abundant, in spite of the disturbance to which they were subjected during the fishery in the spring, 4,580 living specimens being brought up in 291 dives; but, further, that the coral-incrusted shells, to which I have already referred (p. 30), as being a distinguishing characteristic of this bank as compared with the Tholayiram par, are very abundant, the living corals growing on the shells of living oysters, which, did they migrate, would have, sometimes, to carry about with them a weight of nearly

eight ounces. The coral-incrusted shells had, prior to the fishery of the Muttuwartu par this year, only been seen by Captain Donnan on the north-west Chéval par; and, when the oysters disappeared from the latter in 1888, the drift-oysters, which were eventually found, were recognised by the coral-growths upon them. Arborescent sea-weeds, forming tangled masses, such as abound on the Tholayiram par, were conspicuously absent; but the oyster shells were largely encrusted with sponges, and the orange-coloured sponge, *Axinella donnani*, which receives its specific name after the present Inspector of Pearl Banks, was very common. In addition to the shell-incrusting corals, massive corals, mainly belonging to the genus *Madrepora*, flourish on the bank, forming a convenient habitat and hiding place for chætopods, crustaceans, molluscs, &c., which can live there safe from the attacks of predaceous enemies. As far as I could gather from repeated examination, on different parts of the bank, of the residue left after shaking up the oysters in a bucket of water, and of the contents of the digestive tract of a holothurian (*H. atra*) which abounds on the bank, the sea-bottom is mainly composed of a white deposit, such as I have only seen on the Indian coast of the Gulf of Manaar, which consists of a calcareous alga and of foraminifera, among which *Rotalia calcar*, *Heterostegina depressa*, and *Amphistegina lessonii* are the most conspicuous. It was long ago pointed out by Captain Steuart that the places, on which pearl fisheries have been successfully held in Ceylon, appear to be beds of madrepora of irregular heights, having the spaces between the ridges nearly filled up with sand. The transparent clearness of the water over the banks and the clean state of the sea bottom, which is free from sediment carried down by currents, must, I think, be regarded as important conditions favouring the healthy growth of the oysters thereon.

Swimming about on the surface of the water over the bank were many black and yellow striped sea-snakes, which are believed by the divers to feed on the oysters. Indeed, in 1862, the European diver reported that he had seen the snakes eating the oysters, darting into the shells when opened. But this report must be viewed with grave suspicion. Apart from snakes, the reputed enemies of the pearl oyster on the Ceylon banks are molluscs, fishes, and currents. Among molluscs are mentioned the chank (*Turbinella rapa*) and a big *Murex* (*M. anguliferus*), known as the elephant chank. But, as Mr. Holdsworth observes, "they may be looked on

as part of the vermin of the banks, but I have no reason to think they cause more destruction on the oyster beds than the hawk and the polecat do among the game of an ordinary preserve." It is noticeable that the little *Modiola* known as *suran*, which assumes such a prominent position in the reports of the Inspector of Pearl Banks at Tuticorin, does not, though present, occur, so far as I am aware, in any great quantities on the Ceylon banks. Among fishes the trigger fishes (*Balistes*), commonly known as "old wives," are abundant on rocky parts of the banks, and I saw many specimens caught by the boatmen fishing from the side of the ship as we lay at anchor. Concerning these fishes Captain Steuart reports that "the sea over the pearl banks is well stocked with various fishes, some of which feed on the oysters, and, when caught by the seamen on board the guard vessel, pearls and crushed shells are often found in their stomachs, particularly in the fish called by the Malabars, the clartee; by the Singhalese, the pottooberre; and by seamen, the old women. This fish is of an oval-shape, about 12 inches in length and 6 inches in depth from the top of the back to the under part of the belly, and is covered with a thick skin. We saw ten pearls taken from the stomach of one of these fish on board the *Wellington*." The contents of the stomach and intestines of *Balistes*, which I examined while we were inspecting the Chéval par, consisted entirely of young oysters crushed by their sharp cutting teeth. In addition to the trigger fishes, rays are said to be always more or less numerous on the banks, and Mr. Holdsworth states that "when the fishery of 1863 commenced on the south-east part of the Chéval par, the divers reported the ground so covered with skate as to interfere with their picking up the oysters. After a day or two the continual disturbance by the divers had the effect of driving the skates away from that part of the bank, and these fish, many of them of very large size, were seen going in the direction of the Modrigam, which was then covered with oysters, whose age was estimated by the Superintendent at $2\frac{1}{2}$ —3 years, by the Inspector at $3\frac{1}{2}$ —4, and by the native headman at 4 years. The skates were in shoals, and their total number was estimated at from 10 to 15 thousand. Further, in his report on the inspection of banks in March 1885, Captain Donnan notes the fact that "on the way from the north Mótaragam, and just about the south side of the bed of oysters, we passed through a large patch of thick discoloured water, caused by a shoal of rays

plundering about on the bottom, and stirring up the sand. Some of them could, at times, be seen near the surface, and I have no doubt they were feeding on the oysters." Some years ago the Sea Customs Officer at Dutch Bay counted as many as 300 rays in a single haul of a fishing net. The native belief is that the rays break up the oyster shell with their teeth, and suck out the soft animal matter. The stomach contents of a big ray (*Ætobatis narinari*), 5 feet in breadth and with a tail $8\frac{1}{2}$ feet in length, which was caught by fishermen from a canoe off Silávaturai when we were at anchor there, consisted of sea-weed. The same fishermen caught for me off the Silávaturai reef a male Dugong, 9 feet in length, whose stomach contents consisted of sea-weed and large numbers of a nematode worm (*Ascaris halicores*, Owen).

It was roughly estimated as the result of the inspection of the Muttuwartu par, which lasted over three days, an average of 16 oysters to a dive being allowed, that it contained 30 million oysters spread over an area of $9\frac{1}{2}$ million square yards, which should produce a revenue of 5 lakhs of rupees.

On November, 2nd we left the Muttuwartu par, and anchored in 8 fathoms, about 2 miles further north, so as to hunt for a possible bed of oysters. The divers, making the usual preliminary dives, brought up blocks of dead coral-rock with living *Turbinariæ* and *Porites* growing on them, and containing, imbedded in the crevices, a large number of foraminifera. The sample of 15,000 oysters from the Muttuwartu par, which were beginning to be unpleasant fellow-passengers, was sent up to Silávaturai to be washed. It is stated by Captain Steuart that the offensive effluvium of decomposing oysters "is not considered to have an unhealthy tendency on the persons engaged in the kottus, and it is astonishing how soon the most sensitive nose becomes accustomed to the smell. Indeed some Europeans have fancied their appetites sharpened by visiting the kottus, and being surrounded by immense heaps consisting of millions of oysters in all stages of decomposition."

The surface of the water, always rich in organisms, was exceptionally so on the following morning, the tow-net, dropped from the stern of the barque and kept distended by the gentle current which was running, becoming speedily filled with a gelatinous mass composed mainly of *Sagittæ* mingled with a host of ctenophora, glassy pteropods, and hungry fishes preying on crustacean and other

larvæ. Only a few young oysters being found, we again proceeded northward, and anchored in $8\frac{1}{2}$ fathoms, the preliminary dives bringing up madrepores with *Antedons* entwined round their branches, and large melobesian nodules. Again only a few scattered oysters were obtained as the result of a day's work, but the divers brought me many specimens of alcyonians, and the bright-red sponge *Axinella tubulata*, living attached by a broad base to dead coral-rock, and associated with its commensal worm.⁵ The following temperature observations were made half a mile west of the ship, where no bottom was reached with the sounding line at 140 fathoms:—

Surface	.. 81.5°	50 fathoms	.. 75°
20 fathoms	.. 76.5°	100 ,,	.. 62.5°
30 ,,	.. 76°	140 ,,	.. 55°

On the afternoon of the 4th, we moved on, still northward, to the Karaitivu par,⁶ which was estimated, at the inspection in November, 1887, to contain 1,605,465 oysters. The divers, going down from the ship, alighted on a bank of *Fungia*, and brought up some living 5-year old oysters and melobesian nodules. Attached to one of the nodules was an extensive creeping colony of the delicate crimson-coloured organism named *Tubipora reptans* from the single small specimen which has hitherto been recorded by Mr. H. J. Carter.⁷ The present specimens were in a more advanced stage of growth than the one described by Mr. Carter, which I examined in the Liverpool Museum, and the calyces were proportionately higher. By about four hours' work next morning a sample of 8,000 oysters was collected for valuation, and the abundance of oysters may be judged from the fact that, on more than one occasion, as many as 100 oysters were brought up at a single dive. My own share of the morning's work consisted of a *Fungia* (*F. repanda*) and three living specimens of the mother-of-pearl oyster, *Avicula* (*Meleagrina*) *margaritifera*, attached by its byssus to coral-rock. Captain Donnan informed me that he had only seen about a dozen specimens of this mollusc during his 28 years' experience as Inspector of the banks,

⁵ Vide *Ann. Mag. Nat. Hist.*, Feb. 1889, p. 89.

⁶ The Karaitivu par was fished in December 1889; but the fishery came to an abrupt termination owing to a diver being killed by a shark. Apparently three men went down into the water, and two came up almost directly, saying that the third had been carried off by a shark. The rest of the divers could not be prevailed on to resume work, and left the bank.

⁷ *Ann. Mag. Nat. Hist.*, June 1880, p. 442.

so that it cannot be present in any abundance. Shell-incrusting corals, though present on the bank, were far less common than on the Muttuwartu par.

On the afternoon of the 5th we sailed about 20 miles north, and anchored in 2 fathoms, 3 miles south of the village off Aripu, off Silávaturai, which is made the headquarters at times when the Chéval and Mótaragam (Mud-rigam) banks are fished. Rising from the sandy shore between Aripu and Silávaturai is a miniature sand-cliff, reaching a maximum height of about 12 feet, and extending over a distance of about half a mile, which contains a thick bed composed almost entirely of pearl-oyster shells—evidence of the enormous number of oysters which have been taken from the neighbouring banks at fisheries in the past. Similar beds of oyster shells were exposed in sections nearly a mile inland. The Chéval and Mótaragam banks are situated from 9 to 12 miles out at sea in water varying in depth from 6 to 10 fathoms. Between the shore and the banks the water gradually reaches a depth of 6 fathoms; but, as in the case of the Muttuwartu and Karaitivu pars, the depth increases rapidly to 150 fathoms outside the banks. The sea bottom between the shore and the banks is made up mainly of sand with many worn shells, a luxuriant growth of sea-weeds, and scattered coral patches. Among mollusca *Modiola tulipa*, and the chank (*Turbinella rapa*) were very abundant. No fishing for chanks is permitted south of the Island of Manaar, lest, at the same time, raids should be made on the pearl banks.⁸ The fishery is, however, actively carried on north of the island on a different system to that which is in force at Tuticorin (p. 56), the boat-owners paying a small sum of money annually to Government, and making what profit they can from the sale of the shells.

Writing of the banks off Aripu, which have been, for many years, the sheet-anchor of the Ceylon fishery, Captain Steuart observes that “the number of successful fisheries obtained on the banks lying off the Aripu coast, more than on any other banks in the Gulf of Manaar, and the high estimation in which the pearls from these fisheries are deservedly held, would seem to indicate some peculiar quality in the bottom of the sea in these parts, which is favourable to the existence of pearl-oysters, and for bringing

⁸ See *Ordinance relating to Chanks*, pp. 58 to 62.

them to the greatest perfection. We know there is something in the nature of the bottom of certain parts of the sea, which is favourable to the subsistence and growth of particular fishes, and which improves the flavour for the food of mankind: for instance, the sole and the plaice caught in Hythe bay on the Kentish coast are esteemed better than those caught off Rye on the western side of Dungeness; and we also know that cod, turbot, oysters, and, indeed, most edible fishes are prized in proportion to the estimation in which the banks are held, from whence they have been taken." The productiveness of the banks off Aripu (Chéval and Môtaragam) was attributed by Mr. Vane, who was formerly Superintendent of the pearl fisheries, to their position affording a degree of protection from the influences of the weather and currents—conditions which would be favourable for permitting the young oysters to settle on the sea-bottom instead of being carried away.

In 1885 Captain Donnan attempted to cultivate the pearl-oyster on a coral reef, three miles from the shore, which was considered to be sufficiently far removed from the baneful influence of the Aripu river during the freshes. A tank for the reception of the oysters was dug in the centre of the reef, and surrounded by blocks of coral to form a barrier round its edge, heaped up high enough to be just awash at the highest tide. But the experiment failed, as, out of 12,000 oysters which were placed in the tank, only 27 remained alive at the end of seven months. "Some of the oysters," Captain Donnan writes, "may have been washed out of the tank by the south-west monsoon sea, as it was not completely sheltered from the wash of the waves, but the bulk of them have, I believe, died off and been destroyed by some fish preying upon them. About 100 dead shells were found in the bottom of the tank, many of which bore evidence of having been bored and nibbled away. It is just possible that some fish may have got into the tank, and preyed upon the oysters, either by getting over the coral barrier around it, which would be slightly under water at high-water, or through the interstices of the coral underneath. The experiment so far has been a failure, and may be attributable to four causes:—

"(1) overcrowding the oysters in the tank;

"(2) deficiency of nourishment in water so near the surface;

"(3) destruction by fish, which had got into the tank and preyed upon them;

“(4) by excessive agitation of the water in the tank during the south-west monsoon sea ; or, probably, to all these causes combined.”

In March, 1886, another experimental tank was made on a more sheltered part of the reef, and 5,000 oysters were placed in it. But, in the following year, all the oysters were found to be dead. The artificial cultivation of the pearl-oyster was attempted some years ago in a nursery made in the shallow muddy water of the Tuticorin harbour without success ; and, in his final report to the Ceylon Government, Mr. Holdsworth expresses his opinion, with which I thoroughly concur, that there is no ground for thinking that artificial cultivation of the pearl-oyster can be profitably carried out on the Ceylon coast, as the conditions necessary for the healthy growth of the oysters are not to be found in the very few places, where they could be at all protected or watched.

On the way to Captain Donnan's tank, which we visited, we rowed over extensive banks of alcyonians, of the luxuriant growth and size of which only a very feeble idea is obtained from dried or spirit specimens as seen in museums. On the sandy bottom a large number of echinoderms, solitary or clustered together, were clearly visible ; and, with the assistance of the divers and the dredge, the following species were procured :—*Temnopleurus toreumatiscus*, a violet-spined *Temnopleuroid*, *Pentaceros thurstoni*, *Salmacis bicolor*, *Laganum depressum*, *Fibularia volva*, *Echinolampas oviformis*, *Holothuria atra*, and *Colochirus quadrangularis*. These species, as also *Oreaster lincki* and *Linckia laevigata*, which abound on the Muttuwartu par, are all found on the opposite coast of the Gulf of Manaar. A single young specimen of *Hippocampus* was also brought up in the dredge. The tank, washed by the gentle swell, showed no signs of pearl-oysters, which had, doubtless been smothered and disappeared below the surface of the bottom. But, growing from the inner side of the barrier of dead coral which formed the wall of the tank was a fringe of living corals—*Montipora*, *Pocillopora*, *Madrepora*, &c. As these corals had grown in their present position since the construction of the tank, which was built up entirely of *dead* blocks of solid coral brought from the shore, the living corals on the reef being found to be too brittle to form a suitable wall, it was obvious that, as the tank was built in March 1886, the age of the corals did not exceed three years and nine months. Accordingly I

had the largest specimen of *Montipora* carefully detached from the dead coral-rock on which it was growing, and found that it measured 40 inches in length, 9 inches in height, and 16 inches in breadth, and weighed 17 pounds.

After remaining at anchor for some days off Silávaturai, we started on the morning of the 10th for the western side of the great Chéval par, which is known by the divers as *kodai* (umbrella) par from the prevalence on it of a shallow cup-shaped sponge, *Spongionella holdsworthi*, which is supposed, by their imaginative brains, to resemble an umbrella. In a letter to Mr. Bowerbank, by whom this sponge was described,⁹ Mr. Holdsworth stated that "is only found on the 9-fathom line of the large pearl bank. It is attached to pieces of dead coral or stones. When alive it is of a dark brown; and when taken out of water it looks exactly like dirty wet leather. . . . This sponge is so strictly confined to the locality above mentioned that its discovery by the divers is considered the strongest evidence that the outer part of the bank has been reached." Another conspicuous sponge on this bank was the large, pale pink-coloured *Petrosia testudinaria*, which also lives on the Tholayiram par off Tuticorin.

It was from the Chéval par that, in 1888, about 150 millions of oysters, ripe for fishing, disappeared in the space of two months, between November and February. This disappearance *en masse* was attributed by the natives to a vast shoal of rays, called *sankoody tyrica* or *koopu tyrica*, which are said to eat up oyster shells. But the more practical mind of the Inspector of the pearl banks attributed the disaster—for such it was from a financial point of view—to the influence of a strong southerly current, which was running for some days in December; a current so strong that the Engineer of the 'Active' had to let go a second anchor to prevent the ship from dragging.

The divers, going down from the ship as soon as we were at anchor over the bank in 6½ fathoms, reported abundance of young oysters, whose average breadth at the hinge was .75 inch, said by some to be three months, by others six months' old. The samples which they brought up from the bottom, which was rocky and interspersed with patches of fine sand, were attached to dead coral, *melobesiæ*, sponges, and any other rough surface suitable for the attachment of the byssus. That the pearl-oyster prefers a rough to a

⁹ *Proc. Zool. Soc.*, 1873, p. 25, pl. v.

smooth surface as an anchorage is shown not only by its usual habitat, but also by the observation that young oysters have been found clinging to the coir rope moorings of a bamboo, but not to the bamboo itself or the chain moorings. The number of young oysters on a small nodule brought up by the divers was counted, and found to be 180, scattered among which were 20 specimens of the little *suran*.

The prevailing stony corals on the west Chéval par, brought up by the divers with dense clusters of young oysters adhering to them, belonged to the genera *Porites*, *Astræa*, and *Cyphastræa*, growing from a base of conglomerated sand-rock, which is known by the divers as 'flat rock.' These corals, when broken up, proved a rich hunting ground for small crustaceans, tubicolous worms, and lithodamous mollusca. Very abundant on the bank were the bright-red *Juncella juncea* and the cork-like *Suberogorgia suberosa*, on the axes and branches of which clusters of young oysters were collected.

At the time of his annual inspection of the west Chéval par in 1888, Captain Donnan found a large portion of it stocked with oysters one year old, which had, in the interval between the inspections, died from natural causes, or been killed off, and replaced by another brood. The life of the pearl-oyster must be a struggle, not only during the time at which it leads a wandering existence on the surface,¹⁰ and is at the mercy of pelagic organisms, but even after it has settled down on the bottom, where it is liable to be eaten up by fishes, holothurians, molluscs, &c., or washed away from its moorings by currents; and comparatively few out of a large fall of "spat" on a bank can reach maturity even under the most favourable conditions. "Much," Captain Steuart writes, "appears to depend on the depth of water over the ground, and the nature and quality of the soil upon which brood oysters settle, whether any portion of them eventually reaches the age of maturity. If the deposit be of small extent, or be thinly scattered, the young oysters are often devoured by fishes, before the shells are hard enough to protect them. But when the deposits settle in dense heaps upon places favourable for their nourishment and growth, many of them survive to become the source of considerable revenue." How great is the struggle of the pearl-oyster for

¹⁰ Young pearl-oysters have been found attached to floating timber and buoys, and to the bottoms of boats.

existence is very clearly shown by the records of the Tuteur inspections, in which, time after time, a bank is noted in one year as being thickly covered with young oysters, and in the next year as being blank. Not, in fact, till a bank is thickly covered with oysters two years old can any hope be held out that it will eventually yield a fishery.

Outside the west Chéval par a sand flat extends for some distance north and south, from which the dredge brought up masses of coarse, broken shells, and, among other specimens, large numbers of *Amphioxus* and *Clypeaster humilis*, and single specimens of *Ophiothrix aspidota* and *Astropecten hemprichii*; the digestive cavity of the latter being distended by a large *Meretrix* (*M. castanea*) and seven other smaller molluscs, which it had swallowed. From the stretch of sand between the east and west Chéval pars the echinoids *Echinodiscus auritus* and *Metalia sternalis* were obtained.

During our stay on the west Cheval par, large numbers of the butterfly *Papilio* (*Menelaides*) *hector* were seen daily fluttering around the ship 10 miles out at sea. The 'Active' steaming at the rate of 4 knots an hour, and the diving boats under sail caught many seir fish (*Cybium guttatum*) with a long line towing astern and made fast to the yard arm of the lug sail, and baited with a piece of white rag. For catching seir the hooks are sometimes baited with a small fish or the white of a cocoanut cut into the shape of a fish. From the barque at anchor many *Balistes* and the crimson-coloured *Lutjanus erythropterus* were caught by the crew with lines baited with fish. The stomachs of the former always contained crushed pearl-oysters, and those of the latter small fishes.

On the 14th we inspected the small Periya par, situated 3 miles westward of the west Chéval par, which we found irregularly stocked with young oysters. Sounding seaward from the bank, we found 9 fathoms at a distance of 1 mile, 14 fathoms at a distance of 2 miles, and did not strike bottom at 150 fathoms at a distance of 4 miles. The sea bottom shelves here less abruptly than outside the Muttuwartu par, where a depth of 150 fathoms was obtained at a distance of $\frac{3}{4}$ of a mile from the seaward face of the bank. The thermometer registered 54° at 150 fathoms, and 59° at 100 fathoms, the surface temperature being 83°. On this and the two preceding days a bright blue-eyed *Palæmonid* larva was very abundant on the surface.

The next four days, during which the weather was very unpleasant and suggestive of a cyclonic storm in the Bay of Bengal, were spent in inspecting the east Chéval par. The divers, going down as soon as we had anchored at the north end of the bank, brought up blocks of incrustated sand-rock, and specimens of the black-colored sponge *Spongionella nigra*, but no oysters, which were, in fact, absent over the entire bank. This bank is mainly characterised by the abundant growth on it of *Suberogorgia suberosa*, on the branches of one of which an *Astrophyton* (*A. clavatum*?) was entwined, and heather-like *Hydroids* (*Campanularia juncea*, Allman), the tangled branches of which were studded with the striped *Avicula zebra*, and which should afford good anchorage for young oysters. Conspicuous among other specimens which were obtained, were the sponge *Hircinia clathrata* affording a home to *Balanus* (*Acasta*) *spongites*, the corals *Turbinaria crater* and *Turbinaria patula*, and the echinoderms *Antedon palmata*, *Salmacis bicolor*, *Clypeaster humilis*, and *Echinaster purpureus*. A single specimen of *Ophiothrix aspidota* was found coiled up in a cavity in a block of *Porites*. As on the other banks which we inspected, sea-weeds were not present in any quantity. The quantity of weed on the banks is said, however, to vary much from year to year.

The inspection of the east Chéval par completed, we went a short distance south, and spent a couple of days on the Mótaramag pars, which were also blank so far as oysters were concerned. The pearls from these pars are highly valued by the pearl-merchants, and, at the fishery of 1888, the oysters fetched from 100 to 109 rupees per thousand at auction, a single day's fishing realizing over 60,000 rupees. The weather had cleared up by this time, and the divers were again able to work in comfort for a short time. Rain interferes very much with an inspection, as the divers complain that it makes them cold and shivery when they come out of the water. Here, as on the east Chéval par, the animal collected in greatest abundance was *Clypeaster humilis*; but the divers also brought up many specimens of the chank, the unpleasant looking animal of which is eaten by the natives; *Pinna bicolor*, which is said to occur on the sandy parts of the banks in beds of some extent; and the hammer-headed oyster. The hydroid, which was so conspicuous a feature of the east Chéval, was absent from the Mótaramag par.

At this stage a strong south-west wind came on, accompanied by an unpleasant swell, and drove us into Silávaturai ; but, luckily, all the important work of the inspection tour was finished, two small banks alone remaining to be examined. A rolling journey on the tug 'Active' brought me back to Colombo, and my second visit to Ceylon, more auspicious than the first, was over.

During the last quarter of a century, the Ceylon Government has derived a handsome profit from its pearl banks, which have been lucratively fished on ten occasions ; while, during the same period, the banks belonging to the Madras Government have yielded only two small fisheries, not because the oysters have ceased to settle, when young, on the banks, but because they have failed, owing to a combination of physical and other unfavourable conditions, to reach maturity there. Writing, in 1697, for the instruction of the political council of Jaffnapatnam, the then commandant of that town justly remarked that the pearl fishery is an extraordinary source of revenue, on which no reliance can be placed, as it depends on various contingencies, which may ruin the banks, or spoil the oysters. And this remark holds good after the lapse of two centuries. In 1740 the Baron von Imhoff, on his departure from the Government of Ceylon, in a memoir left for the instruction of his successor, stated that "it is now several years since the pearl banks have fallen into a very bad state both at Manaar and Tuticorin ; this is mere chance, and experience has shown that, on former occasions, the banks have been unproductive even for a longer period than has yet occurred at present." And a century later, in 1843, Captain Steuart, at the commencement of his admirable "Account of the Pearl Fisheries of Ceylon," refers to the failure at that time of the now lucrative Ceylon fishery. Is it then rash, looking back to the fluctuating experience of the past, to express a belief that, in the not far distant future, the reputation of the Tuticorin banks will rival that of the at present well-favoured banks of Ceylon ?

The name of Captain Donnan has repeatedly appeared in this chapter, and I should be, indeed, ungrateful were I to fail to acknowledge not only the great assistance which I received from him in carrying out my zoological work, but also the vast store of information on matters connected with the Ceylon pearl-fisheries which I gathered from him during our month of pleasant banishment from the outside world.



Lith. Govt School of art Calcutta.

CHANK SHELL.

IV.—TUTICORIN CHANK FISHERY.

THE sacred chank, conch, or sankhu, is the shell of the gastropod mollusc *Turbinella rapa*, of which a full-grown specimen is represented on plate IV, and is, like the pearl oyster and the edible trepang (*Holothuria marmorata*), one of the commercial products of the Gulf of Manaar.

The chank shell, which one sees suspended on the forehead and round the necks of bullocks in Madras, is not only used by Hindus for offering libations and as a musical instrument in temples, but is also cut into armlets, bracelets, and other ornaments. Writing in the sixteenth century, Garcia says:—"And this *chanco* is a ware for the Bengal trade, and formerly produced more profit than now and there was formerly a custom in Bengal that no virgin in honour and esteem could be corrupted unless it were by placing bracelets of *chanco* on her arms; but, since the Patáns came in, this usage has more or less ceased, and so the *chanco* is rated lower now."

"The conch shell," Captain C. Day writes in "his Music and Musical Instruments of Southern India," is not in secular use as a musical instrument, but is found in every temple, and is sounded during religious ceremonials, in processions, and before the shrines of Hindu deities. In Southern India the sankhu is employed in the ministration of a class of temple servers called Dâssari. No tune, so to speak, can of course be played upon it, but still the tone is capable of much modulation by the lips, and its clear mellow notes are not without a certain charm. A rather striking effect is produced when it is used in the temple ritual as a sort of rhythmical accompaniment, when it plays the part of *kan-nagólu* or *tâlavinyasa*.

The use of the chank as ornament is well shown by a series of specimens in the ethnology court of the Indian Museum, Calcutta, which comprises necklaces worn by Naga women, armlets worn by Kuki women, bracelets worn by Mikir and Butia women, and bracelets (some of gauntlet pattern) made at Dacca.

The chank appears as a symbol on some of the coins of the Chalukyan and Pándyan kingdoms of Southern India, and on the modern coins of the Máharájas of Travancore.

The chank fishery is conducted from Tuticorin, and the shells are found in the vicinity of the pearl banks, in about seven to ten fathoms,¹ either buried in the sand, lying on the sea bottom, or in sandy crevices between blocks of coral rock. The fishery goes on during the north-east monsoon, from October to May, and is worked by native divers, who, putting their foot on a stone to which a long rope is attached, are let down to the bottom, carrying a net round the waist, in which they place the chanks as they collect them. The shells of the chank are scattered about, and not aggregated together in clusters like those of the pearl oyster, so that the divers have to move about on the bottom from place to place in search of them. The divers usually stay beneath the surface about fifty seconds. The longest dive which I have myself witnessed was fifty-four seconds, and on that occasion the diver, on his return to the surface, innocently inquired how many minutes he had been under water. A single case is on record of a native diver being drowned from greed in overloading his net so that he was unable to rise to the surface.

The number of chanks collected in a day varies very much according to the number of divers employed and other conditions; and the records show that as many as six thousand or as few as four hundred have been collected. The divers, who are furnished with canoes, ropes and other apparatus, are paid at the rate of Rs. 20 per thousand shells. At the close of the day's fishery the chanks are brought on shore, and examined. Those which are defective, either from cracks or irregularities of the surface from their having been gnawed by fishes or bored by marine worms, are rejected. The remainder are tested with a wooden gauge having a hole $2\frac{3}{8}$ inches in diameter. Those shells which pass through this hole are discarded as being too small, and returned to the sea on the chance that the animal may revive and continue to grow; those which are too large to pass through the hole are stored in a godown (store-house), where the animal substance is got rid of by the process of putrefaction, which is assisted by flies and other insects. In the month of July the shells are sold by auction in one lot to the highest bidder. In 1886 the highest offer was Rs. 96 per thousand by a native of Kilakarai, which was accepted.

¹ For a discussion of the chank as an enemy of the pearl oyster, *vide* Mr. H. S. Thomas' *Report on Pearl Fisheries and Chank Fisheries*, Madras, 1884.

The following statement shows the number of chank shells fished, and the net amount realised from 1881 to 1893 :—

Years.			Chanks fished.	Net amount realised.	Remarks.
				Rs.	
1881-82	303,590	28,450	The good results in 1890-91 were due partly to the beds having been very little fished for three years; but mainly to the employment of coral divers, whom the Ceylon Government refused to receive for their pearl fishery.
1882-83	...	...	247,696	22,038
1883-84	...	...	210,005	11,347
1884-85	...	...	No fishery.	
1885-86	...	...	332,757	23,970
1886-87	...	...	183,398	10,703
1887-88	...	...	50,558	4,137
1888-89	...	...	26,537	901
1889-90	...	...	55,639	3,091
1890-91	...	...	343,726	19,413
1891-92	...	}	316,354	8,038	
1892-93	...				
Total	1,32,088	

It would seem from Simmond's 'Commercial products of the Sea' that the chank fishery was, in days gone by, more lucrative than it is at present; for it is there stated that "frequently 4,000,000 or 5,000,000 of these shells are shipped in a year from the Gulf of Manaar. In some years the value of the rough shells, as imported into Madras and Calcutta, reaches a value of £10,000 or £15,000. The chank fishery at Ceylon at one time employed 600 divers, and yielded a revenue to the Island Government of £4,000 per annum for licenses."

A right-handed chank (*i.e.*, one which has its spiral opening to the right), which was found off the coast of Ceylon at Jaffna in 1887, was sold for Rs. 700. Such a chank is said to have been sometimes priced at a lakh of rupees (Rs. 1,00,000); and, writing in 1813, Milburn says² that a chank opening to the right hand is highly valued, and always sells for its weight in gold. Further, Baldæus, writing towards the end of the seventeenth century, narrates the legend that Garroude flew in all haste to Brahma and brought to Kistna the *chianko* or kinkhorn twisted to the right.

The curious egg capsules of the chank, of which many specimens were brought up for me by the Tuticorin divers,

² *Oriental Commerce*, vol. I, p. 357.

have been thus described by my predecessor, Dr. G. Bidie, who says of them³: "The spawn of the *Turbinella* consists of a series of sacs or oviferous receptacles, the transverse markings in the figure indicating the dimensions of each capsule. In the fresh state the membranous walls of the sacs are pliable, although tough and horny; and it will be observed that, during the drying process, the spawn has, from the irregular shrinking of the two sides, become curved and twisted so as to have somewhat the appearance of a horn. The larger oviferous sacs of the *Turbinella* spawn contain from 8 to 10 young shells each, but the smaller ones, towards the end of the specimen, are barren."

The largest number of young shells which I found in a single egg-case was 235, of which the average diameter was .62 inch.

The chank fisheries of the Ceylon coast of the Gulf of Manaar are protected and regulated by an ordinance, which I give in detail.

ORDINANCE RELATING TO CHANKS.

No. 18.—1890.

WHEREAS it is expedient to amend the Laws relating to
 Preamble. chanks and to prohibit the diving for,
 and collecting of, chanks, bêche-de-
 mer, coral, or shells in the seas between Mannár and
 Chilaw: Be it therefore enacted by the Governor of Ceylon,
 by and with the advice and consent of the Legislative
 Council thereof, as follows:—

1. This Ordinance may be cited for all purposes as
 Short title and date of operation. "The Chanks Ordinance, 1890," and
 it shall come into operation at such
 time as the Governor in Executive
 Council shall, by proclamation in the *Government Gazette*,
 appoint.

2. The Ordinance No. 4 of 1842, intituled "An Or-
 Repeal. dinance for the protection of Her
 Majesty's rights in the digging for

³ *Madras Journal of Literature and Science*, vol. XXIV, 1879, pp. 232-234.

Dead Chanks," and the Ordinance No. 5 of 1842, intituled "An Ordinance for the protection of Her Majesty's Chank Fishery," are hereby repealed, but such repeal shall not affect the past operation of either of the said enactments, or anything duly done or suffered, or any obligation, or liability, or penalty accrued or incurred under them or either of them.

Where any unrepealed Ordinance incorporates or refers to any provision of any Ordinance hereby repealed, such unrepealed Ordinance shall be deemed to incorporate or refer to the corresponding provision of this Ordinance.

Definitions. 3. In this Ordinance, unless the context otherwise requires—

"Chanks" includes both live and dead chanks.

"Person" includes any company or association or body of persons whether incorporated or not.

4. (1) There shall be levied and paid on all chanks entered for exportation a royalty at such rates not exceeding one cent on each

Duty on chanks. chank, as the Governor, with the advice of the Executive Council, shall, from time to time by notification in the *Government Gazette*, appoint.

(2) No chanks shall be exported save and except from any port mentioned in the schedule A hereto, or from any other port which

Ports of entry. the Governor in Executive Council may appoint by notification in the *Government Gazette*.

5. (1) The person entering outwards any chanks to be exported from any port shall deliver to the collector a bill of the entry there-

Bill of entry. of, expressing the name of the ship and of the master, and of the place to which the chanks are to be exported, and of the person in whose name the chanks are to be entered, together with the number and value thereof, anything in the Ordinance No. 17 of 1869 to the contrary notwithstanding, and shall at the same time pay to the collector any sum which may be due as royalty upon the exportation of such chanks.

(2) Such person shall also deliver at the same time one or more copies of such entry, and the

Collector's warrant. particulars to be contained in such entry shall be written and arranged in such form and manner, and the number of such copies shall be such as the collector shall require, and such entry being duly signed

by the collector shall be the warrant for examination and shipment of such chanks.

6. Every person who shall export chanks from this Island except from any port mentioned in schedule A, or from any port appointed by the Governor in Executive Council under section 4, or contrary to the requirements of section 5, shall be guilty of an offence punishable with simple or rigorous imprisonment for a period not exceeding six months, or with a fine not exceeding one hundred rupees, or with both.

Penalty for exporting contrary to the Ordinance.

7. If any chanks subject to the payment of any sums due as royalty in respect of exportation shall be laden or water-borne to be laden on board any ship before due entry shall have been made and warrant granted, or before such chanks shall have been duly cleared for shipment, or if such chanks shall not agree with the bill of entry, the same shall be liable to forfeiture together with the package in which they are contained.

Chanks laden before entry liable to be forfeited.

8. It shall not be lawful for any person to use any dredge or other apparatus of a like nature for the purpose of fishing for or collecting chanks, and every person using any dredge or other apparatus of a like nature for such purpose shall be guilty of an offence punishable with simple or rigorous imprisonment for a period not exceeding six months, or with fine not exceeding one hundred rupees, or with both; and every dredge or apparatus of a like nature so used as aforesaid shall be forfeited.

Use of dredge collecting chanks prohibited.

9. It shall not be lawful for any person to fish for, dive for, or collect chanks, bêche-de-mer, coral, or shells in the seas within the limits defined in schedule B hereto, and every person who shall fish for, dive for, or collect, or who shall use or employ any boat, canoe, raft, or vessel in the collection of chanks, bêche-de-mer, coral, or shells in the said seas, shall be guilty of an offence punishable with simple or rigorous imprisonment for a period not exceeding six months, or with fine not exceeding one hundred rupees, or with both; and

Collection of chanks, bêche-de-mer, coral, or shells in the seas between Mannár and Chilaw prohibited.

Penalties.

every boat, canoe, raft, or vessel so employed as aforesaid, together with all chanks, bêche-de-mer, coral, or shells unlawfully collected, shall be forfeited.

Provided that nothing in this section contained shall

Proviso. prevent any person from collecting coral or shells from any portion of the said seas in which the water is of the depth of one fathom or less.

Provided also that it shall be lawful for the Governor in

Proviso. Executive Council from time to time or at any time, by notification in the *Government Gazette*, to alter the limits defined in schedule B hereto, or exempt any portion or portions of the seas within the said limits from the operation of this Ordinance.

10. (1) Any chank, bêche-de-mer, coral, shell, boat, canoe, raft, vessel, dredge, or apparatus liable to forfeiture under this

Chanks, &c., liable to forfeiture may be seized and detained at the nearest custom-house.

Ordinance may be seized by any officer of the customs or police, or by any headman, or by any person appointed for that purpose in writing by the government agent of the province or the assistant government agent of the district within which such seizure is made, and when seized shall be conveyed to the custom-house nearest to the place of seizure and there detained until the court having jurisdiction in the matter has determined whether the same shall or shall not be forfeited.

(2) If any such officer, headman, or person shall neglect to have any chank, bêche-de-

Penalty on seizing officer neglecting to convey seizure to custom-house within a reasonable time.

mer, coral, shell, boat, canoe, raft, vessel, dredge, or apparatus seized by him conveyed to such custom-house within a reasonable time, he shall be guilty of an offence and liable to a

fine of one hundred rupees.

11. (1) Every prosecution under this Ordinance may be

Police court to have jurisdiction.

instituted in the police court of the division in which the offence was committed or where the offender is found, and such court may by its order declare and adjudge any chank, bêche-de-mer, coral, shell, boat, canoe, raft, vessel, dredge, or apparatus seized and detained under this Ordinance to be forfeited, and such forfeiture may be in addition to any other punishment hereinbefore prescribed, anything

in the Criminal Procedure Code to the contrary notwithstanding.

(2) All forfeitures may be sold or otherwise disposed of in such manner as the police court may direct.

12. It shall be lawful for the court imposing a fine under this Ordinance to award to the informer
 Informer's share. any share not exceeding a moiety of
 so much of the fine as is actually recovered and realised.

SCHEDULE A.

Kankésanturai.
 Kayts.

Jaffna.
 Pésálai.

SCHEDULE B.

Eastward of a straight line drawn from a point six miles westward of Talaimannár to a point six miles westward from the shore two miles south of Talaivilla.

Passed in Council the Nineteenth day of November, One thousand Eight hundred and Ninety.

MADRAS GOVERNMENT MUSEUM.

Bulletin No. 2.

NOTE ON TOURS
ALONG THE
MALABAR COAST.

BY

EDGAR THURSTON, C.M.Z.S., ETC.,
Superintendent, Madras Government Museum.

MADRAS:

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS.

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493-81

NOTE ON TOURS ALONG THE MALABAR COAST.

Soon after my arrival in India, in 1886, accompanied by my staff of taxidermists, who excel in fish-stuffing, I made a short tour on the western coast of the Madras Presidency, from Cochin southwards by the system of backwaters—the home of otters and crocodiles—to Trivandrum, the capital of the Máharája of Travancore. The object of this tour was the making of an initial collection of the fishes of Malabar for the Madras museum, and the greater part of the time was spent at Cochin, which affords abundant natural facilities for fish capture. More recently, in 1894, a tour was made from Cochin northward to Cannanore, with halts at Calicut and Tellicherry, with a view to making a survey of the littoral fauna of the Madras coast of the Indian Ocean with the assistance of the dredge.

The work of the tours commenced on each occasion at Trichúr, a large town 20 miles from the station of Shoranúr on the Madras Railway, from which place Trichúr is easily reached, by a well-avenued road, in bullock cart or pony transit. Between Shoranúr and Trichúr is the village of Vadakanchéri, where the best Trichúr mats are made. At Trichúr fishing is actively carried on with nets from boats in the fine open sheet of water, which extends for some miles south of the town. The fish market contained an abundant supply of fish caught locally, as well as fish sent from Cochin by backwater.

At the time of my visit in 1886, the phenomenon of phosphorescence was extremely brilliant on the first night spent on the backwater; the fishes, as they darted to and fro, being so brilliantly illuminated that I at first thought that it must be caused by *Micrococcus phlügeri*, a microscopic luminous organism which grows in colonies on the skin of fishes. But, on collecting some of the water in a tumbler, I discovered that the phosphorescence was really produced by myriads of small medusæ, many of which contained tiny crustacea imbedded in their gelatinous substance. Phosphorescence in all its brilliancy I have, in the course of many wanderings

along the coast of Southern India, only seen on one other occasion, viz., on the Pulicat lake, north of Madras; and, in this instance, it was produced by hosts of *copepods*.

The natives who live along the backwater between Trichúr and Cochin, and rely largely on the products thereof for physiological sustentation, are able to obtain not only an abundance of a bivalve mollusc (*Velorita cyprinoides*), whose shells are collected together and burned into chunám (lime); but also of fish, which they capture with line or net, or, more simply, by wading in the shallow water and picking the fish out of the muddy bottom with their hands. Fish and shell fish, as captured, are cleaned from the adhering mud, and placed in chatties attached to a string held between the teeth, and floating on the surface of the water. The fish which I saw captured in greatest abundance were *Etroplus suratensis*, *Etroplus maculatus*, and *Gobius giuris*.

The town of Cochin is situated on the south side of the entrance of the most considerable river in Malabar. This river opens into the sea out of a broad lagoon with a dense background of cocoanuts, which, with the distant line of hills, wrapped in a grey haze in the spring months, form the leading characteristic of the scenery throughout the whole length of the backwater.

The Cochin backwater abounds in oysters (*Ostrea*, sp.), which live in clumps on the stone and wood-work (freely bored by an isopod crustacean), and have their shells encrusted with anemones, barnacles, and mussels. The oysters, though eaten by the European community, occasionally give rise to an acute intestinal crisis.

The north bank of the Cochin river is formed by the island of Vypeen, which is said to have been created in 1341 A.D. by a cyclone or earthquake. Climbing up the gneiss and conglomerate boulders, which are piled up as groynes at Vypeen point, where the river enters the sea, and serve as an abode for the mollusc *Littorina undulata*, were the crustacea *Grapsus strigosus* and *Metagrapsus messor*.

The shells on the Vypeen shore, used for the manufacture of chunám, belong to coarse species of *Venus*, *Arca*, *Tapes*, &c., evidently rolled in from a distance, and worn or broken by wave action; whereas those on the south shore are more delicate, and suited for museum exhibition. The south shore is riddled with the burrows of giant oecypods (*Oecypoda platytarsis*), the smaller *Oecypoda cordimana*, and the "calling crab," *Gelsimus forceps* (?), which emerge from their hiding

places in the morning and evening, and are difficult to catch as they scamper along the sand.

To travellers Cochin is best known as the home of the Jews, black, white, and half-caste, concerning whose history and customs a great deal of interesting information is contained in Days' *Land of the Permauls; or Cochin Past and Present*. But it is, from a commercial standpoint, a very important centre of trade in coir fibre, cordage, kopra (dried cocoanut kernels), cocoanut oil, ginger, &c.

The exports from Cochin of the products of the sea, in which I am most interested, were in 1892-93—

				RS.
Fish, salted	..	..	lbs.	308,560 45,860
„ dried, not salted	..	..	„	226,002 22,839
„ oil	..	..	gals.	12,541 5,874
„ maws ¹}	..	..	..	} lbs. 17,044 6,683
Shark fins	..	..	..

My camp at Cochin was pitched in the 'compound' of the travellers' bungalow, facing the tidal river, which affords anchorage, in 7 to 9 fathoms, for craft of light draft, such as can pass over the sandy bar, and load and discharge cargo in smooth water. The bungalow is a noted resort of thieves, and was, during my stay there in 1886, guarded at night by a constable armed with the saw of a young saw fish (*Pristis*), with the base cut away so as to form a handle.

From the bungalow a scene of busy activity can be witnessed from early morning until sunset. The large open 'compound,'—the resort of stray cattle and goats, which caused endless annoyance by rubbing their noses into and licking up my specimens drying in the sun—forms a convenient spot for fishermen to spin the cotton thread for their nets by a simple contrivance consisting of a stick weighted at the end to which the thread is attached, and deftly swung round the head. Visitors to the bungalow are beset by professional mendicants making an income out of the prevalent elephantiasis (Cochin leg), which attacks young and old alike; and vendors of stuffed crocodiles with flat glass panes for eyes, and mouths lined with red or yellow flannel, and jewellery of local manufacture made from the small silver coins (*puttans*) of the Native State of Cochin.

¹ "I have to come down from the regions of high finance to grovel among fish maws and shark fins; but these articles will bring me in sufficient revenue to pay for the salary of a High Court Judge for half a year."—*Speech by the Finance Minister to the Imperial Legislative Council, March, 1894.*

Stored in the bungalow 'compound' are casks of fresh water, brought daily from the sanitarium of Alwayi, about 20 miles from Cochin. The water of the Alwayi river, from which I obtained a unique dredging consisting of stone gods, has a good reputation, and on it the European community of Cochin depends largely for its supply of wholesome water.

At the time of my visit to Cochin in 1894, boring operations, in search for good water, were being actively pushed forward near the protestant church, one of the oldest, if not the oldest, European churches in India. The Dutch tombstones, the legends on many of which commence with the words 'Hier rust' (though the bones 'rust' elsewhere) had been transferred, between my visits in 1886 and 1894, from the floor to the walls of the church.

Lining the Cochin river on both the north and south banks are rows of Chinese or parallelogram dip-nets, about 16 feet square, which are let down into the water, and, after a few minutes, drawn up again. These nets afford an easy and certain source of income, and, like other fixed engines, "produce an 'unearned increment' to the owner, irrespective of his skill, or of his being a member of the fishing community proper."² The men who work the nets stand protected from the sun within a cadjan shed or beneath the shade of a portia³ or 'tulip tree' (*Thespesia populnea*), whence they emerge to pick the fish out of the net (the apex or bottom of which is brought within reach by a long rope) with a hand-net. When the fishes are small and few in number, the fishermen are defeated by the ever-watchful crows, who in company with pariah kites (*Milvus Govinda*) sit perched on the wooden framework of the net, waiting anxiously for it to be hoisted up out of the water.

In March, 1886, enormous quantities of mullet (*Mugil pœcilus*), characterised by a deep black spot in the centre of the scales, were being caught daily in the parallelogram nets. This fish is used extensively as food, and the roe is considered a great delicacy. Another species of mullet (*M. cunnesius*) was also caught, but in far smaller quantities.

Placed across the Cochin backwater, in which long-nosed dolphins (*Delphinus dussumieri*) may frequently be seen

² F. J. Talfourd Chater, Prize Essay. *Fisheries Exhibition, London*, 1883.

³ "The word portia is a corruption of Tamil pu-arassu, flower-king." *Hobson-Jobson*.

disporting themselves, are bamboo labyrinths and rows of bamboo stakes with nets affixed thereto at flood-tide. These bamboo stakes serve as convenient perches for hosts of the smaller sea tern (*Thalasseus bengalensis*) on the look-out for food. Fishermen, simply clad in a loin-cloth and wide-spreading circular hat made of palmyra leaves, may constantly be seen fishing in the river or backwater from canoes ('dug-outs') with lines or nets; fishing with bait from the jetties; or, in the cold season, trolling at the mouth of the river for bà-mìn (*Polynemus tetradactylus*), a specimen of which, estimated as weighing over 300 lbs., and a load for six men, was recorded by Buchanan Hamilton ('Fish-Ganges') from the Gangetic estuary.

The deep-sea boats (*i.e.*, the boats which fish outside the shallow waters of the littoral zone) secured daily, in March, 1886, large hauls of *Engraulis malabaricus*, *Engraulis indicus* ('anchovy'), and *Dussumieria acuta*, known all along the Malabar coast as the sardine. These fishes are salted and dried for food, and the surplus is used for the extraction of fish-oil. Also brought in by the deep-sea boats for sale in the fish bazár, were the common crustacea *Neptunus pelagicus*, *Neptunus sanguinolentus*, *Thalamita prymna*, and *Squilla nepa*.

Fish-oil is extracted in largest quantities at Cochin from August to December. Hundreds of tons of the oil are said to have been annually exported from Cochin in former times, and I find that the average export thereof in the five years 1856 to 1861 was 19,630 cwt. The oil-trade is, however, reported to be decreasing year by year. In some seasons the sardines arrive off the coast in enormous numbers, or, for several consecutive years, they may be present only in quantities sufficient for purposes of food. The result of this irregularity is that one important element of success in commercial enterprise—regular supply—is wanting. In some years large shoals of sardines appear, and suddenly disappear. Contracts for the supply of oil are made on the arrival of the fishes, and, in the event of their disappearance, the contractor loses heavily. The natives of Cochin say that formerly the sardines always arrived regularly, and remained throughout the season; and the fishermen's belief is that they are at the present day frightened away by the numerous steamers which call at Cochin, and retire in search of a less disturbed spot. In addition to steam-boat traffic, noises in boats, ringing church bells, artillery practice, the erection of light-

houses, gutting fish at sea, using fish as manure, burning kelp, and the wickedness of the people, have been charged with being responsible for a falling-off of the fish supply; but, as Mr. C. E. Fryer naively remarks "of these alleged causes only the last, it is to be feared, has been, and is likely to be, a permanent factor in the case."

The preparation of the evil-smelling fish-oil is carried out in large iron cauldrons, in which the fish are boiled with a little water. The oil, as it exudes, rises to the surface, is strained through cloth, and stored in barrels. The residue in the cauldrons is preserved and utilised as manure for cocoanut gardens, paddy fields, &c.

A rougher and cheaper process of oil extraction, by which the cost of cauldrons and firewood was saved, has been practically put a stop to as being an offensive trade. This process consisted simply in putting the fishes into a canoe, and exposing them to the influence of the sun until decomposition set in. The oil then rose to the surface and was removed with a scoop. By this crude process a comparatively small quantity of oil was obtained.

A portion of the oil is consumed locally by boat owners for smearing their boats so as to preserve the wood and coir rope, with which the planks are stitched together. But the bulk is exported to Europe and some Indian ports. The natives believe that the oil returns from Europe in the guise of cod-liver oil.

During my stay at Cochin a journey was made by backwater to the mud-bank of Narrakal, which, like that of Alleppy, affords smooth water anchorage for big ships during the boisterous weather of the south-west monsoon. The mode of formation of these mud-banks, which has given rise to much speculation, has been most recently dealt with by Mr. P. Lake⁵ of the Geological Survey of India, who states his opinion that "the Narrakal mud-bank is very probably, to a large extent, formed of the silt carried down by the Cranganore river. It does not appear to be very much affected by the rise of the backwaters."

The surface of the vast liquid mud-flats of the backwater between Cochin and Narrakal, through which our boat was laboriously propelled, is covered with a dense mass of a mollusc (*Telescopium fuscum*), which produces a curious

⁴ *Fisheries Exhibition, London, 1883. Prize Essay.*

⁵ See *Lake Rec. Geol. Surv. Ind.*, vol. XXIII, 1890; and *King. Rec. Geol. Surv. Ind.*, vol. XVII, 1884.

appearance as of the spikes of the helmets of a submerged army. On the sandy shore at Narrakal great quantities of the mollusc *Dactylina orientalis*, were being washed up by the in-flowing tide; and the neighbouring muddy shore was strewn with full grown shells of the pearl-oyster, *Avicula fucata*. These pearl-oyster shells were not worn, and must have been rolled in by the sea from a bank at no great distance from the shore. Of the existence of such a bank I can find no record; but, in the event of the shells being recognised hereafter, it would be worthwhile to have an inspection made on the chance of discovering a bank which might yield material for a fishery on a small scale by the Tuticorin divers.

A single night's journey by British India coasting steamer brought me from Cochin to Calicut, the chief town of the Malabar district. Landing was possible from a wherry at the sandy beach, on which, except during the south-west monsoon storms, the waves flow with a gentle ripple, affording a strong contrast to the surf-beaten shore at Cochin.

A cursory examination of 'specimens' washed on shore showed at a glance that the littoral fauna of Calicut differs in a very marked degree from that of Cochin, and demonstrated the necessity of detailed examination of the entire coast line, if any semblance of an approach to an accurate knowledge and museum record of the nature and distribution of the littoral fauna of Southern India (with which alone I am concerned) is to be acquired.

For the great mass of visitors to museums in India,⁶ who come under the heading of sight-seers, and who regard museums as *tamasha* or wonder houses, it matters but little what exhibits are displayed, or how they are displayed, provided only that they are attractive. I am myself repeatedly amused by seeing visitors to the Madras museum pass hurriedly and silently through the arranged galleries, and linger long and noisily over a heterogeneous collection of native figures, toys, painted models of fruits, &c. But, in addition to the sight-seers, those have to be considered who regard museums in the light of institutions where they should

⁶ The numbers of visitors to the Madras museum during the years 1888-94 were as follows:—

1889-90	..	..	378,234
1890-91	..	..	364,542
1891-92	..	..	361,452
1892-93	..	..	341,238
1893-94	..	..	311,112

be able to acquire solid information; and our Indian museums would be fulfilling a very useful function if, in the capital city of each province, collections were brought together and properly exhibited, illustrating and forming a classified index to the natural history, ethnology, arts, archaeology, economic resources, &c., of the province concerned.

To return, however, to Calicut. Not only do many of the delicate mollusca washed on shore belong to different genera to those at Cochin, but very conspicuous by their abundance were the siphonophora *Velella* and *Physalia* (Portuguese man-of-war); the shells of an edible mollusc (*Mytilus viridis*); the young of the cirrhiped *Balanus tintinnabulum*, the carapaces of the crustacean *Matuta miersii*;⁷ the burrowing crustacean *Hippa asiatica*, swarms of which are destroyed by fishermen with each cast of their shore nets, and heaped upon shore; sharks' vertebræ, teeth, and egg-cases attached to drift coir fibre; worn madreporarian coral fragments, doubtless carried across by currents from the Laccadive Islands; and a pennatulid (*Cavernularia malabarica*, sp. n., Fowler.) This pennatulid was being cast ashore in large numbers at the time of a visit to Calicut during the southwest monsoon, 1893, with the object of ascertaining whether Calicut could serve as a source of supply of cowry shells (*Cypræa moneta*) for the Belgian Congo State.⁸

The crustacean *Hippa asiatica*, which lies buried between tide-marks on the Calicut beach, is collected by digging with the hands, roasted with medicinal herbs purchased in the bazar, and applied as a fomentation to sore legs.

After some days spent in dredging at Calicut, the journey was continued by road to Tellicherry, one of the most delightful drives in the plains of Southern India. Conspicuous by their abundance were the cocoanut, and betel palm (*Areca Catechu*); the deciduous silk-cotton tree (*Bombax malabaricum*) in full flower; black pepper vines (*Piper nigrum*) twining up the trunks, and sheltered by the branches of the coral tree (*Erythrina indica*); the cashew (*Anacardium occidentale*) laden with ripening nuts; and jack-fruit trees (*Artocarpus integrifolia*) with the young fruits protected by wicker baskets from the attacks of predatory birds.

The transfer of the pony carts to the ferry boats, by which the passage of the three rivers opening into the sea

⁷ J. R. Henderson, *Journ., Mad. Lit. Soc.*, 1887.

⁸ The supply was eventually arranged for by a Bombay firm.

between Calicut and Tellicherry is effected, afforded an opportunity of studying the habits of the 'calling' or 'dhobi' crabs (*Gelasimus annulipes*), which abound in the mud between tide-marks. These crabs were hard at work with their young families making the burrows which serve as their dwelling places; the adults bringing up between their feet from the bottom of the burrows in course of construction mud rolled into pellets, which they pushed with their feet to a distance of several inches from the mouth of the burrow; cleaning the feet from adherent particles of mud, and again descending into the burrow, remaining under ground from ten to twenty seconds. In the work of removing the mud pellets from the mouths of the burrows the adults were zealously assisted by the young.

A few miles south of Tellicherry the quiet and picturesque French settlement of Mahé was passed, and at the octroi or customs chowki declaration of contraband goods, alcoholic and other, had to be made. At Mahé the manufacture of *sardines à l'huile* is, I believe, still carried on; and that fish-curing operations are carried on there was clear from the strong odour at the northern outskirts of the town.

Tellicherry with its miniature bays, low cliffs of gneiss and laterite (extensively used for building purposes), and sea-girt rocks forming a natural brickwater, is a charmingly picturesque place, which ranks high as a centre for fish-curing operations, as is evidenced by the following statistics gleaned from the administration reports of the department of salt revenue :—

Year.	Weight of fish cured.	Weight of Salt issued.
	MAUNDS.	MAUNDS.
1888-89	88,675	14,654
1889-90	89,162	12,655
1890-91	103,705	15,344
1891-92	93,733	12,556
1892-93	104,226	13,708

Fish-curing operations were slack at the time of my visit in March 1894; only a few sardines and mackerel (*Scomber microlepidotus*), which is not nearly such good eating as the British mackerel, being in various stages of preparation.

Sardines are caught in large numbers from October to January, either close in shore, in two or three fathoms, or

from eight to ten miles out at sea. If they are very oily, a boat-load will be worth only from 8 annas to a rupee, as the fishes are, when in this condition, unsuited for salting and drying. The surplus supply of sardines is sent to Coorg, Travancore, Colombo, etc. as fish-manure for planters' estates, at the rate of Rs. 27 to Rs. 28 per ton at Tellicherry. Those fish which are salted and dried for food are sent up-country to Coorg, the Wynád, &c., and by coasting steamer to Tuticorin and other coast towns, freight being charged at the rate of 12 annas per bundle of 165 lbs.

The Tellicherry fish-curing yards are situated on the shore at the southern extremity of the town in proximity to the fishermen's quarters. The shore opposite the yards was, at the time of my visit, crowded with a dense mass of crows and terns on the look-out for succulent fish morsels.

The cost of the store-houses and fences and of keeping them in good repair has to be borne by the fish-curers, for the most part Mukkuvar women, who, as set forth in a recent petition to His Excellency the Governor of Madras, "have to work in the fish-curing yards both day and night, and separate themselves from their babies." The annual expenditure under this head is said to amount to Rs. 250 to Rs. 300 at Tellicherry, and Rs. 150 at Cannanore; the greater expense at the former place being due to the fact that the fences are there situated near the sea and get damaged by the breakers during the south-west monsoon.

The boat-owners, who keep the boats in repair and supply the nets, allow the boat's crew (fourteen men to a pair of boats) half the value of the take, which is divided among the men; and, in addition, encourage them to work by giving them a present of a small percentage of the fish. The crew have to be maintained by the boat-owner, to whose service they are pledged, during the south-west monsoon from June to October, when, unless the monsoon is exceptionally light, fishing operations come to a standstill. The boat-owners hand over their share of the spoil to their own ticket-holders (licensed fish-curers), or sell it to other ticket-holders.

The boats, which cost from Rs. 250 to Rs. 500, are made of *aini* wood (*Artocarpus hirsuta*, a lofty evergreen tree of the western ghâts), and last for many years. The nets cost from Rs. 50 to Rs. 200. A pair of properly equipped boats requires about twenty nets, valued at about Rs. 1,500, adapted for catching different kinds of fish, *e.g.*, nets of narrow mesh and thin thread for sardines and mackerel, and of wide mesh and thick thread for cat-fishes.

The boats, on their return from the fishing ground, are beached opposite the fish-yards, which, with the prevailing odour (far less offensive, however, than the odour of putridity which emanates from decomposing oysters) recalled the days spent in the pearling camp at Tuticorin. The fish, as soon as they are landed, are taken to a shed outside the fence which protects the curing-yards against thieves, where they are cleaned; the guts (which might be utilised as manure) being buried in the sand. They are then carried down to the sea in baskets and washed. After washing, they are taken to the weighing shed, where they are weighed, and government salt is issued in proportion to the weight of the fish at a rate, which has in recent years been raised from 12 annas to 1 rupee per maund.

At Tellicherry a sub-Inspector assisted by a staff of peons is responsible for weighment of the fish and distribution of salt to the ticket-holders, who number over a hundred. After a good haul, a ticket-holder may have 60-70 maunds of fish or more. The whole of this has to be weighed, calculations have to be made, and salt has to be issued under the direction of the single official with, I was informed, the result that the ticket-holders may have to wait from morning till evening for their salt, the fish meanwhile softening under the influence of the sun.

As soon as salt has been delivered to the fish-curers, the fish are removed to a shed within the fence, salted and put in tubs, wherein small fish have to remain for one night, big fish for two nights. When the salting is complete, the fish are washed in water, which has to be brought from the sea to the yard, and dried on matting in a space allotted to the ticket-holder, covered in by netting to keep out thieving birds.

Big fish are thoroughly dried in four days; small fish, *e.g.*, sardines, in one to three days. When dry, the produce is, in compliance with the rules, again weighed, and either sold to traders, or stored in a shop for which a small municipal tax has to be paid.

The fish are not allowed to be removed from the yard until they are thoroughly dried, and the Mukkuvar fishing community, who seem to suffer from competition with other and richer natives (Moplas and others) with more capital at their command, who deal in cured fish, and buy up a great deal of the fish which comes into the market, complain that they are in consequence precluded from selling partially dried

fish, when a demand for it arises. I was told that the natives of Madura, Chittoor, Vellore, and other places, prefer fish salted without drying, and that the demand cannot be met, as the fish must be thoroughly dried before they leave the yard.

The Mukkuvars complain further that, if, as I was told, happens repeatedly during the north-east monsoon, when big fish, *e.g.*, seir and cat-fish, are caught, the boats come in after 9 P.M., the fish-curers cannot obtain salt until the following morning, by which time decomposition has commenced; and, in the petition to which reference has been made, they asked *inter alia*, that salt be ordered to be supplied to them in the yard at all hours of the day and night, when they require it.

The steady development of the fishing industry on both the east and west coasts of the Madras Presidency in recent years, and the greater importance of the industry on the west than on the east coast are shown by the following tables⁹:

Year.	Weight of fish brought to be cured.		Total.
	East Coast.	West Coast.	
	TONS.	TONS.	TONS.
1886-87	9,526	20,847	30,373
1887-88	12,637	24,858	37,495
1888-89	15,781	25,830	41,611
1889-90	15,233	28,263	43,496
1890-91	16,426	33,768	50,194
1891-92	16,692	30,769	47,461
1892-93	15,737	29,263	45,000

The importance of the Malabar fish industry, relatively to that of the eleven other districts of the Madras Presidency, in which the industry is carried on, is shown by the following table⁹:

Year.	Quantity of salt-fish manufactured in the Malabar district.	Total quantity of salted fish manufactured in all districts of the Presidency.
	MAUNDS.	MAUNDS.
1890-91	434,669	796,500
1891-92	444,300	792,047
1892-93	426,612	732,651

⁹ Administration Report of the Department of Salt Revenue.

In the British trade different kinds of fish are distinguished by the terms 'prime' and 'offal'; and, as the names imply, the former are consumed by the richer, the latter by the poorer classes. In India, even more than in Great Britain, the fish supply is essentially a poor man's question, and the prosperity of the fishing industry depends on the offal, and not on the prime.

In the city of Madras, the 'microscopic minority' of Europeans, who are regular fish-eaters, will go on year after year without seeing at their table any other fish, out of the large variety which is sold in the fish bazar, than seir (several species of *Cybium guttatum*); pomphret, white, silver, grey,¹⁰ or black (*Stromateus sinensis*, *S. cinereus* and *S. niger*); the so-called 'whiting' (*Sillago sihama*); and perhaps an occasional flat-fish (*Psettodes erumei*), which is a poor substitute for the British sole. During three years in Calcutta I only saw served up *hilsa* (*Clupea ilisha*), which, though bony, is excellent when smoked; *begti* (*Lates calcarifer*), and the mangoe fish or *tupsee muchee* (*Polynemus paradiseus*), which comes up the Hooghly river for spawning purposes in very large numbers. Again, at Cochin, out of about forty different kinds of fish classed as edible by natives, which were being caught at the time of my visit, only four were considered fit to place before me, viz., seir, 'whiting', mullet, and sardines.

In the waters of the Bay of Bengal and Indian Ocean, by which the Madras Presidency is bounded, with their enormous and varied fish resources, it may be safely said that there is no danger of exhaustion of supply from over-fishing. The fishing industry is, in fact, from want of capital and lack of commercial enterprise, on the part of the native fishing community, carried on at present on too small a scale to be really profitable, and is capable of great expansion.

In the British seas trawl-fishing is carried on at a distance of 80 to 100 miles from the nearest port, whereas, in the Madras Presidency, *e.g.*, at Tellicherry, the 'deep-sea' boats only go out from 8 to 10 miles from the coast. Short, however, as is this distance, speed in reaching the shore is an advantage, for the boats (in which no provision is made for protection of the fish from the sun), are not allowed by

¹⁰ Silver pomphret is the immature, and grey pomphret the adult *Stromateus cinereus*.

the regulations to take salt to the fishing ground, and, as is well known, decomposition sets in, in tropical climates, with terrible rapidity.

The coast trade is amply provided for by the service of coasting steamers, which constantly ply from port to port, and serve as an easy medium of communication with Colombo, the Clapham Junction of the east. Tellicherry is, however, 40 miles distant from the terminus of the Madras Railway at Calicut; but increased railway communication, with favourable rates for the carriage of fish, and refrigerating vans would do much to advance the up-country distribution of fish, both prime and offal. From returns supplied by the Traffic Manager of the Madras Railway Company, I find that the weight of salt-fish consigned from the west coast (at the rate of 8 pies per ton per mile at owner's risk, and 10 pies at the Company's risk) during the years 1889-93, was as follows:—

Year.	From				Total.
	Tirur.	Tanur.	Parpan- gadi.	Calicut.	
	MAUNDS.	MAUNDS.	MAUNDS.	MAUNDS.	MAUNDS.
1889	51,796	42,618	27,399	22,280	144,093
1890	56,342	48,392	30,331	22,024	157,089
1891	64,040	53,045	30,631	15,348	163,064
1892	44,561	39,849	31,938	15,152	131,500
1893	44,484	31,974	27,446	16,820	120,724

The bulk of the traffic takes place between September and March, and coincides with the time at which fishing is most actively carried on.

For the development of the export trade from the Madras Presidency, which, at the present day, extends outside India (including Burma) practically only to Ceylon, the adoption of improved methods of fish-curing is essential. On this point the Tellicherry boat-owners, who interviewed me, say "How can the poor Mukkuvars afford to introduce improvements?"

It has been argued, with reference to the British fisheries, that "the State should neglect no opportunity of mastering, through the agency of duly-qualified department, every detail, natural, as well as artificial, of the fishing industry, and might do much, apart entirely from 'protection' and 'encouragement' of the fishing industry." Whether the

native fishing community should be trained in improved methods of fish-curing under the direction of experts versed in the methods adopted in the big fish-curing establishments of Europe; whether they should, in their own interests, make an effort to send one or more members of their community to Europe to study these methods for themselves; or whether one or more officials should be deputed to Europe with the object of learning how far the European methods are capable of application to India, it is unnecessary to discuss in this note.



MADRAS GOVERNMENT MUSEUM.

Bulletin No. 3.

RAMESVARAM ISLAND

AND

FAUNA OF THE GULF OF MANAAR.

SECOND EDITION, REVISED WITH ADDITIONS.

BY

EDGAR THURSTON, C. M. Z. S., ETC.,

Superintendent, Madras Government Museum.

MADRAS:

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1895.

Madras Government Museum Bulletins.

No. 1.—PEARL AND CHANK FISHERIES OF THE GULF OF MANAAR.

No. 2.—NOTE ON TOURS ALONG THE MALABAR COAST.

No. 3.—RÁMÉSARAM ISLAND AND FAUNA OF THE GULF OF MANAAR.

No. 4.—ANTHROPOLOGY OF THE TODAS AND KOTAS OF THE NILGIRI HILLS (*in the Press*).

Nature.—"A series of Bulletins of the Madras Government Museum has been commenced by the Superintendent, Mr. Edgar Thurston, and Parts I and II, which have reached this country, contain much useful information upon the fisheries and marine zoology of the Presidency. Part I contains a revised account of the 'Notes on the Pearl and Chank Fisheries of the Gulf of Manaar'; and its subject-matter is already known in great part to British students of 'applied zoology.' Part II entitled 'Note on Tours along the Malabar Coast,' records a number of interesting observations in marine zoology made on the West Coast of Madras. It is interesting to note that even there the natives have their fishery question."

Calcutta Review.—Bulletin No. 1, Pearl and Chank Fisheries. "Wonderful is the quantity of information Mr. Thurston has deftly compressed within the 58 pages of what he modestly calls a Bulletin. Science, archæology, political economy, folklore, Sir Edwin Arnold's poetry, are all laid under contribution, and yet in every page the author's shrewd personality asserts itself. He makes a dull topic bright, and contrives to enliven the driest of details."

Indian Journal of Education.—In Bulletin No. 1 Mr. Thurston gives, in a very pleasant and readable form, an account of his visits to the pearl and chank fishing grounds of the Madras and Ceylon Governments. Those who take an interest in the commercial industries of India will find much valuable information. The naturalist too will discover much that claims his attention in these pages, for in a graphic and interesting way the writer has contrived to throw in a large number of facts relative to the fauna of the Gulf of Manaar.

"No one doubts that the seas, which lave our Indian Coasts, are abundantly stocked with edible fish, but the problem of making these vast resources available for the food supply of the half-fed masses of this country, has never yet been satisfactorily solved. We recommend Bulletin No. 2 to the attention of every thoughtful reader."

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Frontispiece.



THE CALCUTTA PHOTOTYPE CO.

PAMBAN PASS.

E. THURSTON, PHOT.

I.—RÁMÉSIVARAM ISLAND.

IN January, 1887, it was my privilege to accompany the Secretary to Government, Public Works Department, and the Presidency Port Officer, Madras, on a tour of inspection of the light-houses, which come within the jurisdiction of the Madras Government, from Mangalore on the north-west round Cape Comorin to Gopalpur on the north-east. My knowledge of the littoral of the Madras Presidency was, apart from Madras, at that time confined to Rámésivaram island, on which a few days had been spent in 1886, and the west coast from Cochin to Trivandrum, which I had visited, with a view to making a collection of the fishes of Malabar, especially at Cochin, soon after my first arrival in India in 1885. Though the halts at the light-house stations were as a rule very short, this tour of inspection afforded me an excellent opportunity of forming a general idea as to the zoological capacity of the different parts of the coast. The specimens cast up on shore afford in some measure an index to the still living and submerged fauna of the neighbouring sea; and an examination of these, coupled with visits to the fish bazárs, enabled me to decide what parts of the coast were likely to afford the most profitable field for future investigation.

A casual non-scientific observer, walking along the sandy surf-beaten beach at Madras, will probably find nothing to attract his attention except a number of coarse shells destined for the manufacture of chunám (lime), an occasional flattened jelly-fish, and swift-footed crabs (*Ocypoda*) which, on the approach of man, scamper away, and disappear, like rabbits, into their burrows. But, if the same observer walks along the shore at Pámban, he cannot help noticing that, as shown in the frontispiece, it is strewn with broken fragments of dead coral, among which branches of madre-pores are most conspicuous, and sponges washed on shore by a recent tide, or dried up above tide-mark. And, if he trusts himself upon the slimy blocks of coral which are exposed at low tide, and turns them over so as to display their under-

surface, he will find hidden there a wealth of marine animals—crabs, boring anemones, annelids, shell-fish, trepangs (*béches-de-mer*), and bright-coloured encrusting sponges. And the Madras beach may, allowing for differences of species, be taken as fairly representative of the coast of the Presidency, with the exception of the coral-fringed shores of the islands which skirt the coast of the gulf of Manaar, which I have visited on several occasions in the months of July and August. These months, though warm, proved very favorable, owing to the absence of rain, for carrying out investigations, and for the drying of specimens, *e.g.*, stuffed fishes, big sponges, and corals, such as are not suitable for preservation in alcohol or other fluid medium. Even, however, under the most favourable climatic conditions, the work of a marine zoologist beneath a tropical sun is, apart from the personal discomfort caused by the sun and glare on the water, except in the very early morning and towards sunset, attended by many difficulties, which are graphically described by Haeckel, who says,¹ speaking of surface-netting with a gauze tow-net:—"The wealth of varieties of marine creatures to be found in the Bay of Belligam was evident even on my first expedition. The glass vessels, into which I turned the floating inhabitants of the ocean out of the gauze net, were quite full in a few hours. Elegant *Medusæ*, and beautiful *Siphonophora* were swimming among thousands of little crabs and *Salpæ*; numbers of larvæ of mollusca were rushing about, mingled with fluttering *Hyaleadæ* and other pteropoda, while swarms of the larvæ of worms, crustacea, and corals, fell a helpless prey to greedy *Sagittæ*. Almost all the creatures are colorless, and as perfectly transparent as the sea-water in which they carry on their hard struggle for existence, which, indeed, on the Darwinian principle of selection, has given rise to the transparency of these pelagic creatures. But I soon discovered to my grief that, within a very short time after being captured, at most half an hour and often not more than a quarter, most of the fragile creatures died; their hyaline bodies grew opaque, and, even before we could reach the land, I perceived the characteristic odour exhaled by the soft and rapidly decomposing bodies."

Haeckel's experience is, unfortunately, not an uncommon one, and, while staying at Pámban, I frequently had the

¹ *Visit to Ceylon*. Transl. by Clara Bell, 1883.

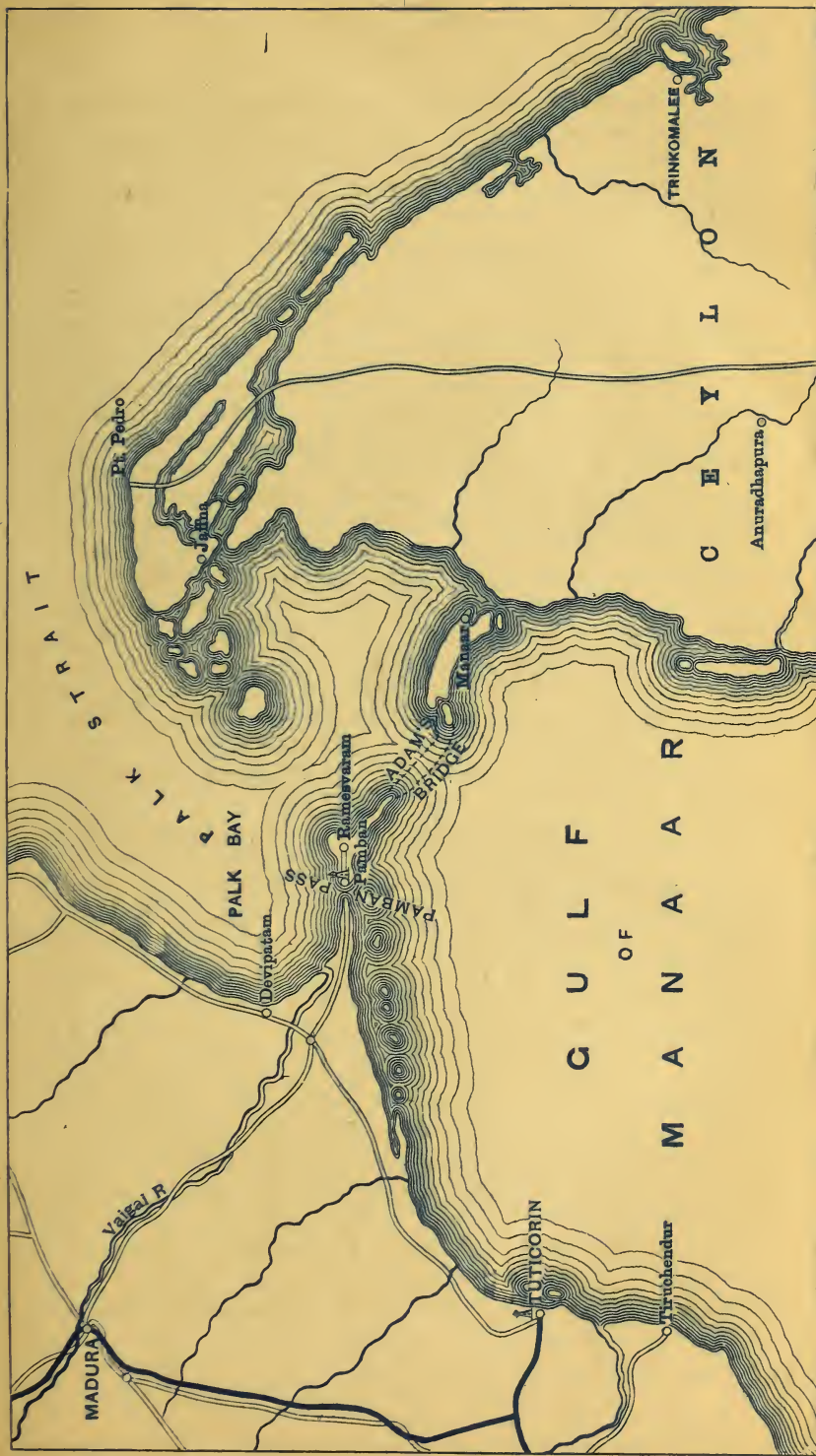
mortification of finding, on my return from a surface-netting expedition to the improvised laboratory at the Rája's bungalow, instead of a crowd of living animals, an amorphous mass composed of their corpses at the bottom of the collecting glasses. It is, in fact, essential for the preservation of many of the gelatinous pelagic organisms that they should, in this country, in the absence of an apparatus by which they can be supplied with a constant stream of cool water, be at once treated with the necessary fixing and preservative re-agents; but the management of the requisite processes is by no means an easy matter in the limited space afforded by a native dug-out (canoe). The suggestion made by Hæckel that the death and decomposition of the delicate organisms might be prevented by placing them in vessels cooled by ice is, without doubt, an excellent one; but unfortunately, ice cannot as a rule be procured in out-of-the-way places where one most requires it.

Among the pelagic organisms which I have collected over the coral reefs in the gulf of Manaar may be mentioned various small *Medusæ*, *Beroë*, *Cydippe*, *Bolina* (present one morning in such abundance that the net became instantly filled with a thick jelly), dense crowds of copepod and schizopod crustaceans sometimes rendering the surface of the water milky; *Zoëa*, *Phyllosoma*, and *Alima* larvæ; violet-blue *Janthinæ*; and *Styliola acicula*, a pteropod mollusc, whose dead glassy shells are very abundant in deposits from the sea bottom. Less frequently met with were young *cephalopods*, of which the adults, as well as a *chætopod* (*Nereis*?) obtained by digging deep holes in the sand, are extensively used as bait by the fishermen; *Salpæ*; and the ova and young of fishes. Floating, too, on the surface of the water, and conspicuous by their bright colouring, were various siphonophora—*Physalia* (the Portuguese man-of-war), *Veella* with its sundial-like crest, and *Porpita* with its exquisitely marked disc. Many minute pelagic animals were obtained by shaking in a tumbler of water the marine algæ which were floating over or living on the reefs, and of which the most conspicuous were *Sargassum vulgare* and *Padina pavonia* (peacock's tail). These pelagic organisms, from which the main food-supply of the coral polyps is probably derived, were far more abundant and varied over the Pámban reef during my visit to Rámésvaram island in 1886 than in 1888: and this is probably to be explained by the fact that, in the former

year, there was but little wind, and the water was so clear that, in the early morning before the gentle day breeze set in, the individual corals could be clearly distinguished as one rowed over the reef; whereas in the latter year there was generally a strong south-west wind blowing, and a rapid current running through the Pámban pass, carrying with it sediment in suspension, which rendered the water turbid: and, as is known, a pure and transparent condition of the water is the first and indispensable condition for the life of many marine creatures, especially those of the coast. Moreover, the ripple on the surface probably drove the pelagic animals into deeper water, which was not explored in search of them. On calm mornings, when the surface has been teeming with small *medusæ*, I have seen the living organisms and their dead gelatinous remains adhering in large quantities to the surface of greedy living coral polyps with their tentacles expanded, which were brought up for me by my divers. There has been a noticeable absence of big jelly-fishes during my visits to Rámésvaram Island. Only, in fact, during the last few days of my stay on the island in 1889 did I see a few large *rhizostomids* (called by the natives *sori*, i.e., nettles), floating over the reef or washed on shore. Phosphorescence, too, I have never seen well marked in the gulf of Manaar, the sight of an occasional luminous flash from a pelagic organism being the poor reward of night vigils.

The island of Rámésvaram, which is visited during the course of the year by enormous numbers of Hindu pilgrims from all parts of India to the celebrated temple, is separated from the mainland by the Pámban pass, which connects Palk's strait with the north end of the Gulf of Manaar, and is 1,350 yards in width. The depths in the channel range from $10\frac{1}{4}$ to 15 feet at low water, but it shoals up very suddenly on both sides, so that great care is necessary in navigating vessels through. "In the Pámban channel," Mr. H. S. Thomas writes in his *Rod in India*, "there are, or at least used to be some twenty years ago, a number of splendid runs. . . . There was a fish there that we used to call the Pámban salmon, and were well content with the name. It turns out to be our mutual friend *Polynemus*."

On the west side of the pass is the great dam, consisting of large masses of sandstone, all having a more or less flat surface, which were formerly part of a causeway extend-



ing from Rámésvaram Island across to the mainland. The remains of this causeway are still visible on the main road from Pámban to the town of Rámésvaram.

According to the folk-lore of the Hindus, the so-called bridge, which formerly connected Rámésvaram island with Ceylon, was built by an army of monkeys when Ráma made war against Rávana, who had, carried off his wife Sita to the island of Lanka (Ceylon), and as Mr. Bruce Foote observes: ² "the series of large flat blocks of sandstone so strongly resemble a series of gigantic stepping-stones, that it is impossible to wonder at the imagination of the author or (in analogy with the Homeric epos) authors of the Ramayana that the rocky ridge was really an old causeway of human construction." A grotesque picture in Moor's 'Hindu Pantheon,' represents Hanumán assisted by Súgríva and their associates building the bridge. In connection with the building of the reef a story goes to the effect that the common South Indian squirrel (*Sciurus palmarum*) used to help the monkeys by rolling in the sand on the shore, so as to collect it in its thick hairy coat, and then depositing it between the piled up stones, so as to cement them together. At which service Ráma was so pleased that he stroked the squirrel on the back, which has, ever since, borne the finger marks.

Writing in 1821 concerning Adam's Bridge, Davy observes ³ that: "No one who looks at a map and notices the little distance (about 17 miles) between the nearest point of the island (Ceylon) and continent, and how, by the chain of rocks and sand-banks commonly called Adam's Bridge, they are still imperfectly connected, can entertain much doubt that the connection was once perfect. This inquiry is more curious than useful. It would be much more useful to endeavour to complete that which nature has begun, and to make the channel, which is now obstructed and dangerous, clear and safe, and fit for the purposes of coast navigation. If, on examination, sandstone and coral rock should be found constituting part of Adam's Bridge instead of primitive rock, one necessary inference is that the channel, at whatever period formed, was once deeper and more open than it is at present, and another inference is that, in process of time, it will be closed up, and Ceylon joined to the continent." The possibility of making an artificial union between

² Mem. Geol. Surv., Ind., vol. xx, 1883.

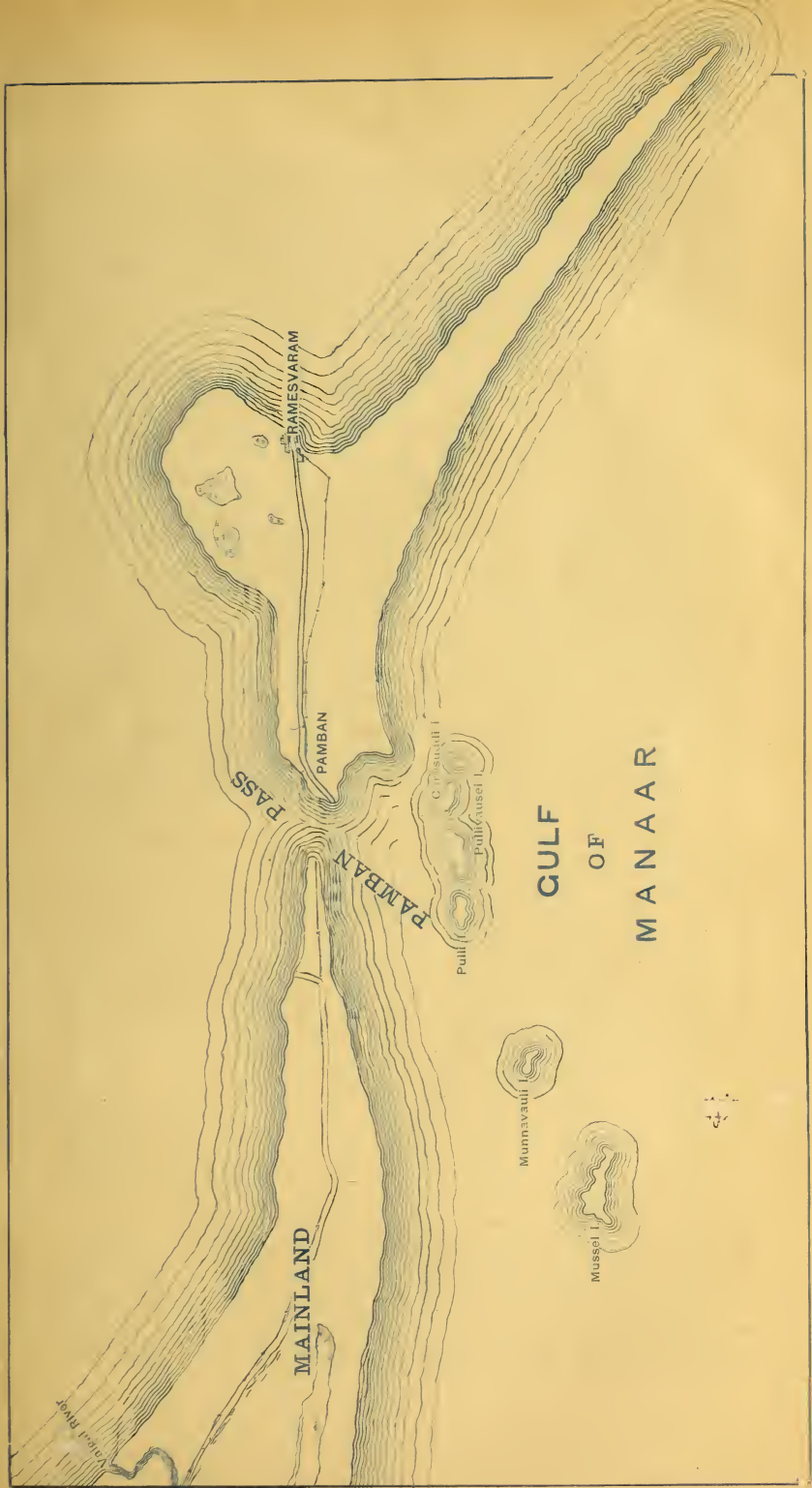
³ Travels in Ceylon.

Southern India and Ceylon, by means of a railway across what remains of Adam's Bridge, is at the present time under discussion.

Tradition runs to the effect that, at the time of the disruption of Rámésvaram island from the mainland on the one side and Ceylon on the other, the cows became prisoners on the island, and being unable, like the cows at Cape Cod, which are fed on herring's heads, to adapt themselves to a fish diet, took to living on sea-weeds, and have become, by degrees, converted into diminutive 'metamorphosed cows,' which may still be seen grazing on the shore. This story is based on the fancied resemblance of the horned coffer-fishes (*Ostracion cornutus*), which are frequently caught in the fishing-nets, to cattle. Portions of the skulls of cats and dogs, including the articulated temporal, parietal, and occipital bones, which are sometimes picked up on the beach, also bear a rude resemblance to the skull of a cow, the horns being represented by the zygoma.

During the time of my stay at Pámban in 1888, a bucket dredger was at work in the pass, and from the mud brought up by it I obtained many small crustacea, echinoderms (chiefly *Laganum depressum* and *Fibularia volva*), mollusca (of which *Leda mauritiana* was one of the most abundant) including great quantities of the little *Avicula vexillum*, which was formerly mistaken for the young of the pearl-oyster, a gephyrean (*Dendrostoma signifer*), *Branchiostoma* (*Amphioxus*), and many fragments of a small *Fungia*, which must be very plentiful, but of which I have never obtained a perfect specimen.

Southward of the Pámban pass are three islands, Pulli, Pullivausel, and Coorisuddy, completely encircled by an irregular coral reef, the whole forming a natural break-water protecting the pass and the channels leading to it from the violence of the south-west winds. The space between the northern edge of this reef and the pass forms a fine sheltered anchorage for vessels of light draft in all weathers. The deepest water between the above islands and the pass is immediately south of Coorisuddy, and is called the basin, over which there is an average depth of 18 feet, but in one spot there is a depth of 21 feet. This basin is, however, very narrow, being simply a hole scoured out by the action of the water in rushing through the pass: and, consequently, is of little value to ships, as it has the pass to the northward of it with only 10 feet, and



the sand-bank channel to the southward with only $9\frac{1}{2}$ feet at low water. The tides are very irregular at Pámban, the rise and fall being much affected by the winds. The average springs rise 3 feet; but, during neaps, sometimes for 48 hours, there is frequently only a rise and fall of 1 or 2 inches. The currents are generally influenced by, and strong in proportion to the force of the wind. Through the Pámban pass the current frequently attains to a velocity of from 5 to 6 knots an hour, rendering it at times difficult even to take full-powered steamers through. During the north-east monsoon the current sets to the north through the pass. The only months in which a real tidal current is noticeable are March, April, and October, when it generally sets six hours each way. No records of the temperature of the water over the reef are extant, and, as my visits have always been at the same season, extending over only a few weeks of the year, the temperature observations which I have made are practically of no value. The following table, however, shows the maximum and minimum and monthly range, recorded at the Pámban marine office in the shade at 10 A.M. and 4 P.M. during the twelve months from April 1st, 1888, to March 31st, 1889. The range of temperature during that period will be seen to be from 76° to 92° , *i.e.*, 16° :—

—	Minimum.	Maximum.	Range.
April, 1888	81°	92°	11°
May „	79°	91°	12°
June „	84°	88°	4°
July „	84°	89°	5°
August „	84°	88°	4°
September, 1888	84°	89°	5°
October „	78°	89°	11°
November „	78°	89°	11°
December „	77°	86°	9°
January, 1889	76°	81°	5°
February „	80°	88°	8°
March „	82°	92°	10°

The town of Pámban is situated on the western extremity of the island, and lies to the west and south-west of the light-house, built on the top of a sand-hill, at the foot of which is a good example of sand-rock, *i.e.*, a mass of fine sand, which has become compacted by the action of wind

and spray, so as to form a stratified friable rock exposed amid the surrounding loose blown sand. With the exception of the Port officer's house and a few others, the houses consist principally of huts made of *cajan* leaves. The native population is mainly made up of boatmen and fishermen, some of whom find employment in carrying coolies over to Ceylon, and others in ferrying the pilgrims bound for the temple at Rámésvaram from the mainland to the island. There are also a large number of coolies, who are engaged in hauling vessels through the pass when the wind is adverse.

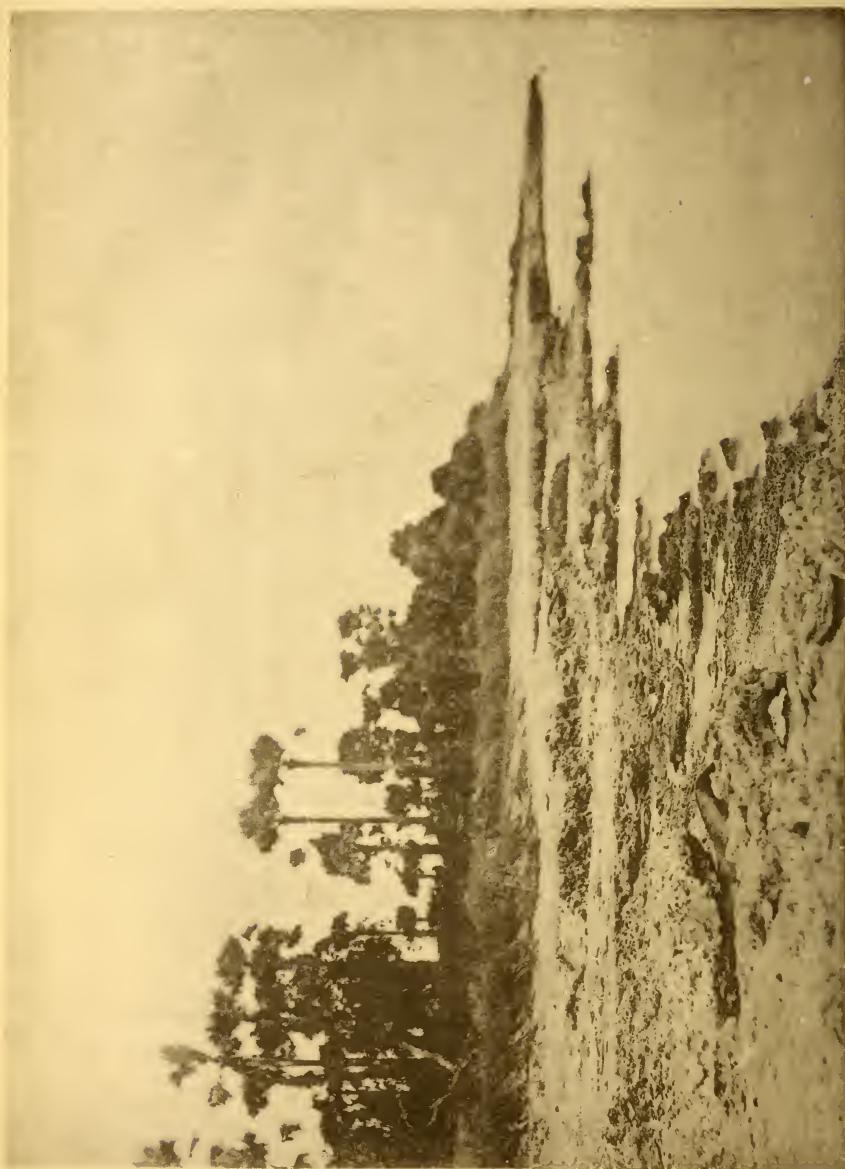
Pámban boasts of a ruined fort built by the Dutch during their occupation of the island, over which I was taken by a native guide, who pointed out as objects of interest some stone cannon-balls, battered dredge-buckets of modern construction, and some barrels of fuse lying mouldering from age in what he termed a *conji* (gruel) house, a damp, ill-ventilated building, wherein, at some period at which the Public Works Department was engaged on works in the island, the recalcitrant sapper used to be placed in confinement on a sedative *conji* diet.

As regards the food-supply at Pámban, beef and mutton are not easily procurable, goat, long-legged and emaciated, being the principal animal supplied. Fowls and native vegetables can always be obtained in the bazár. The local eggs possess a peculiar flavour which is attributed to the fact that the fowls feed partly on fish, affording an example of polyphagy. One is reminded of the observation of John Hunter, that a species of gull (*Larus tridactylus*), though commonly feeding on fish, and having its stomach adapted to flesh diet, can also live on grain. Another species of gull (*Larus argentatus*) is said to live in the Shetland islands on grain in the summer and on fish in the winter. The fish supply at Pámban is very plentiful, and a visit to the ill-smelling fish bazár always showed an abundance of fish, unappetising cephalopods, and crustacea (*Neptunus pelagicus*, *Scylla serrata*, etc.) which make excellent curries, for sale. During my visit in 1889 the following food-fishes were obtained either by means of a drag-net or from the bazár :—

SHARKS AND RAYS.

Zygæna malleus, *Shaw*.
Trygon uarnak, *Forsk*.

| *Myliobatis nieuhoftii*, *Bl. Schn*.



E. THURSTON, PHOT.

THE CALCUTTA PHOTOTYPE CO.

SHORE AT RAMÉSIVARAM

BONY FISHES.

<i>Lates calcarifer</i> , Bloch.	<i>Teuthis oramin</i> , Günth.
<i>Lutjanus rivulatus</i> , Cuv. & Val.	<i>Caranx ire</i> , Cuv. & Val.
<i>Lutjanus roseus</i> , Day.	<i>Caranx speciosus</i> , Gmel.
<i>Therapon theraps</i> , Cuv. & Val.	<i>Equula edentula</i> , Bloch.
<i>Pristipoma hasta</i> , Bloch.	<i>Sillago sihama</i> , Forsk.
<i>Scolopsis</i> , sp.	<i>Mugil speigleri</i> , Bleeker.
<i>Gerres oyena</i> , Forsk.	<i>Cynoglossus macrolepidotus</i> , Bleeker.
<i>Drepane punctata</i> , Gmel.	<i>Arius thalassinus</i> , Rüpp.
<i>Scatophagus argus</i> , Bloch.	<i>Saurida tumbil</i> , Bloch.
<i>Upeneoides tragula</i> , Richardson.	<i>Hemiramphus xanthopterus</i> , Cuv. & Val.
<i>Upeneus indicus</i> , Shaw.	<i>Clupea</i> , sp.
<i>Lethrinus nebulosus</i> , Forsk.	<i>Pellona leschenaultii</i> , Cuv. & Val.

My head-quarters on the island have been mainly fixed at the bungalow of the Sétupati of Ramnád, the head of the Maravars, on whose behalf I once had to appear in the Madura Court, and stand the fire of cross-examination in connection with the coinage of his ancestors on the throne of the Sétupatis (Lords of Adam's bridge). The bungalow is situated on the summit of a sand hill near the Pámban light-house, and would make an excellent marine biological station, easy of access from Madras now that between Negapatam and Pámban there is a service of coasting steamers, of light draft so as to be able to get through the shallow channel of the Pámban pass.

Occasionally my camp has been pitched on the shore at Rámésvaram close to the spot where the pilgrims, under the directions of a priest, go through a course of mysterious ceremonies and ablutions, and deposit in the sea pice and clay images, the former of which are subsequently searched for by the poorer classes.

As pointed out by Dr. Walther, in the extension of the reef band towards the Rámésvaram temple, appears a limestone consisting entirely of calcareous algæ (*Lithothamnium*), with a few scattered coral masses. This extensive deposit is represented on plate V, the back-ground of which is made up of palmyra palms.

The verandah of the Rája's bungalow affords a good spot for the study of the common animals and birds of the island. The former consist mainly of ill-conditioned pariah dogs; goats trying to extract the requisite amount of food stuffs for the maintenance of life from dried palmyra leaves

and the leaves of the umbrella thorn (*Acacia planifrons*), the thorns of which serve as no protection against the attacks of these hard-mouthed herbivorous mammals; and donkeys suffering from motor paresis of their hind limbs. The shrill voiced palm squirrel and musk shrew ('musk-rat') infested the bungalow, and a friendly mongoose made repeated visits when I was at breakfast. Of birds, the splendid but shameless crow (*Corvus splendens* or *impudicus*) made continual raids on my specimens drying in the sun; and parakeets screaming in a neighbouring fig tree, and screech-owls making night hideous with their domestic quarrels, proved a constant source of irritation. Beneath the *Acacia* trees were large numbers of bleached land-shells, which were identified for me by Dr. O. Boettger as being:—

Buliminus (*Rhachis*) *punctatus*, *Ant.*

Buliminus (*Mastus*) *chion*, *Pf.*

Helix (*Eurystoma*) *vittata*, *Müll.* (small form).

Helix (*Trachia*) *fallaciosa*, *Fér.*

Hemiplecta *lixa*, *Blf.*

Xesta *ceylanica*, *Pf.*

As regards *Xesta ceylanica*, Dr. Boettger writes to me:—
 "I am not in possession of original specimens of Blanford's species from the foot of the Anaimalai hills, but I cannot find a difference in the diagnosis. It is a next ally to *H. gardneri* of Ceylon and *H. shiplayi* of the Nilgiris."

During my stay on the island in 1886 the following birds were shot by my shikaree:—

Tinnunculus alaudarius, *Briss.* Kestrel.

Micronisus badius, *Gm.* Shikra.

Athene brama, *Tem.* Spotted owl.

Merops viridis, *Linn.* Common Indian bee-eater.

Palæornis rosa, *Bodd.* Rose-headed parakeet.

Brachypternus aurantius, *Linn.* Golden-backed woodpecker.

Xantholæma indica, *Lath.* Crimson-breasted barbet.

Hierococyx varius, *Vahl.* Common hawk cuckoo.

Coccytes melanoleucos, *Gm.* Pied-crested cuckoo.

Centropus rufipennis. Common coucal ('crow pheasant').

Upupa nigripennis, *Gould.* Indian hoopoe.

Lanius erythronotus, *Vig.* Rufous-backed shrike.

Lanius vittatus, *Val.* Bay-backed shrike.

Dicrurus ater, *Herm.* Black drongo.

Crateropus griseus, *Gm.* White-headed babbler.

Pycnonotus luteolus, *Less.* White-browed bulbul.

Molpastes hæmorrhous, *Gm.* Madras red-vented bulbul.

Ægithina tiphia, *Linn.* Common iora.

Copsychus saularis, *Linn.* Magpie robin.
Corvus macrorhynchus, *Wagl.* Jungle crow.
Corvus splendens, *Vieill.* Indian house crow.
Acridotheres tristis, *Linn.* Common myna.
Temenuchus pagodarum, *Gm.* Black-headed myna.
Turtur suratensis, *Gm.* Spotted dove.
Tringa minuta, *Leister.* Little stint.
Phoenicopterus roseus, *Pallas.* Flamingo.
Xema brunnicephala, *Jerdon.* Brown-headed gull.
Seena aurantia, *Gray.* Large river tern.

On the sandy shore of Shingle island, one of the islands which intervenes between Rámésvaram island and the mainland, which is overgrown with long grass reaching in some places to a height of six feet, my friend Mr. J. R. Henderson saw, in early June, hundreds of a doubtful species of tern (?) and a few of the large river tern (*Sterna seena*). Of these the latter laid a single egg in a tunnel excavated among the matted roots of the grass, and artfully concealed from view. The former laid a single egg in a hole scooped out in the sand near the water's edge, where the grass was either very short or absent; and the eggs were easily missed owing to the resemblance between their colour and that of the sand, which affords an example of the adaptation of the coloring of eggs to their natural surroundings for the purpose of concealment, according to the principle of protective coloration. In July, 1888, the shores of Coorisuddy island were in possession of an army of occupation of flamingoes, which were, no doubt, feeding on annelids and burrowing crabs.

On Coorisuddy Island the following botanical specimens were collected :—

Ærua javanica, *Juss.*
Bœrhavia diffusa, *Linn.* Spreading hog-weed.
Clerodendron inerme, *Gartn.*
Cynodon dactylon, *Pers.* Hariáli grass.
Dodonæa viscosa, *Linn.*
Enicostema littorale, *Blume.* The *chota chiretta* of natives.
Eugenia jambolana, *Lam.* Black plum.
Euphorbia corrigioloides, *Boiss.*
Ipomœa biloba, *Forsk.* One of the most important sand-binding plants.
Launæa pinnatifida, *Cass.* A common plant of the sandy coasts.
Oldenlandia umbellata, *Linn.* Chay-root or Indian madder.
Pandanus odoratissimus, *Willd.* Screw-pine. Recommended by Cleghorn as a very strong sand-binder.
Pemphis acidula, *Forst.*

Phyllanthus niruri, *Linn.*

Salvadora persica, *Linn.* Tooth-brush tree; said by Royle to be the mustard tree of the Bible.

Suaeda monoica, *Forsk.*

Vernonia cinerea. Ash-colored flea-bane. One of the commonest Indian weeds.

The palmyra palm (*Borassus flabelliformis*) grows very abundantly on Rámésvaram island, and the prepared fibre is exported to Ceylon. The method of preparation⁴ consists in detaching from the trunk of the tree the lower part of the leaf which remains clinging to the tree after the leaf has been cut off or dried, beating this with a wooden hammer, and pulling out the fibre which is detached. The best trees for the purpose are said to be young ones from 12 to 15 feet high. The stalks require to be in a certain and particular state of decay, in which the fibre when hammered out will be of a black colour. The white fibre which is obtained from immature stalks is less pliable and more brittle, and fetches an inferior price in the market. The chief objection to palmyra fibre for brush manufacture is that it lacks straightness; but, if this defect could be overcome, it is claimed that palmyra should be found equal to the best Brazilian piassava fibre.

The insect world, apart from the irrepressible ants and mosquitoes, is only poorly represented on Rámésvaram Island, and of lepidoptera the most conspicuous was *Papilio* (*Menelaides*) *hector*, flying swift-winged along the shore or far out at sea. The following common species of lepidoptera were captured in July, 1889:—

Mycæles mineus, *Linn.*

Melanitis leda, *Linn.*

Tarucus plinius, *Fabr.*

Catochrysops strabo, *Fabr.*

Catopsilia crocale, *Cramer.*

Catopsilia catilla, *Cramer.*

Terias hecabe, *Linn.*

Papilio hector, *Linn.*

Papilio erithonius, *Cramer.*

Though I have met with none myself, I have been shown a collection of scorpions (*Scorpio swammerdami*) which were captured at Pámban.

A big spider belonging to the genus *Mygale* (*M. fasciata*?) concerning the bird-eating propensities, of which genus there has been a long-standing controversy,⁵ was caught by me when developing photographs in an impro-

⁴ Report by the Head Assistant Collector, Madura District, 1892.

⁵ See *Journ., Bombay Nat. Hist. Soc.* vol. i, 1886, p. 28.

Pl. VI.



THE CALCUTTA PHOTOTYPE CO.

E. THURSTON, PHOT.

FOSSIL REEF, PÁMBAN.

vised dark room at the Rája's bungalow. Soon after my arrival in Madras, in 1885, a live female *Mygale* was sent to me from one of the districts of the Presidency, on the charge of killing sheep and goats by poisoning them on the muzzle, with a request that I would convict or acquit the accused on experimental evidence. A sheep was accordingly purchased, and the *Mygale* placed in a gauze net which was tied over the sheep's muzzle. For a short time the *Mygale* strolled about, showing no indication of poisonous intent, and then—the sheep put out its long tongue and swallowed her, bringing the experiment to an abrupt termination.

The shells of *Cerithia*, which adhere in dense masses to the reef rock at Pámban, are collected by poor women, and burnt into chunám (lime) in a simple kiln on the shore, fed by a fire obtained by burning drift-wood, seeds, coconut husks, etc., which are thrown up on the beach by the in-flowing tide.

Commencing near the Rája's bungalow, and extending for some distance along the north coast of the island, is a sub-fossil coral reef, which I cannot do better than describe in Mr. Bruce Foote's words:⁶ "The upraised reef," he says, "is a striking feature of the north coast of Rámésvaram Island, and is worthy of much closer study than the time at my disposal enabled me to bestow upon it. It shows best along the beach beginning a couple of hundred yards west of the zemindar's bungalow, where it forms a little irregular scarp about a yard or 4 feet high, against the roof of which the waves break in rough weather. Of its true coral reef origin there can be no doubt, as in many places the main mass of the rock consists of great globular meandroid corals, or of huge cups of a species of *Porites* which, beyond being bleached by weather action, are very slightly altered, and still remain in the position in which they originally grew. The base of the reef is not exposed, as far as I could ascertain, not having been sufficiently upraised along the beach; but in a well-section a little to the south of the Gandhamána Parvattam chattram the thickness of the coral reef exposed above the surface of the water is at least 10 feet, and probably much more. The great swampy flat forming the northern lobe, as it were, of Rámésvaram Island, consists, I believe, entirely of this upraised reef hidden only by a thin coating of alluvium, or the water

⁶ *Mem. Geol. Surv., Ind.*, vol. xx, 1883.

of the brackish lagoons which cover the major part of the surface, but do not form a continuous sheet of water as shown in the map. I came across masses of coral protruding at intervals through the alluvium in the very centre of the flats north-westward of the great sand-hill crowned by the chattram just named. The raised reef is very well seen to the north-eastward of Rámésvaram town, where it forms a miniature cliff from 3 to 4, or possibly 5 feet high, and continuing along the coast after the latter turns and trends to north-west. Time did not admit of my actually following it up to Pesausee Moondel point, but I went to within a mile of the point, and could see no change of character of the coast line on examination through a strong field-glass. The raised reef shows strongly also along the western side of the flat north wards of Ariangundu. The south side of the reef is, along the north coast, completely covered up by the great spreads of blown sands which occupy the greater part of the surface of the island. On the east side of the island the reef does not extend close up to the great temple, but stops short abruptly about 300 yards to the north-east, and does not re-appear on the coast of the bay south of the temple. South of Pámban town also there were no signs of any upraised coral, nor could I see any indication eastward along the south coast, as far as the eye could reach from Coondacaul Moondel point, while the great south-east spit terminating at the point called Thunnuscody is covered by a double ridge of great blown sand-hills. An important series of trial sinkings made by the Port officer at Pámban right across the island, from north to south, about 2 miles east of the town, in order to test the feasibility of the proposed ship canal, did not reveal any southerly extension of the raised reef. The probability is that it forms a mere narrow strip along the beach from Pámban to Ariangundu, but widens out thence to the north-eastward to form the northern lobe of the island. Parts of the reef lying between collections (colonies as it were) of the great globular or cup-shape coral masses form a coarse sandstone made up of broken coral, shells, and sand (mostly silicious) a typical coral sandstone. At the Pámban end of the raised reef it shows a slight northerly dip, and masses of dead coral, apparently *in situ*, protrude through the sand below high water mark. Reefs of living coral fringe the present coast, but these I was unable to examine, so cannot say whether the corals now growing there are specifically allied to those



E. THURSTON, PHOT.

THE CALCUTTA PHOTOTYPE CO.

FOSSIL REEF, PÁMBAN.

which formed the reef now upraised, but all the mollusca and crustacea I found occurring fossil in the latter belong to species now living in the surrounding sea." Mr. Bruce Foote writes further:—"It is quite evident from the occurrence of the old coral reef on Rámésvaram Island that the latter must have been upraised several feet within a comparatively recent period, but unfortunately there are no data by which to calculate the exact amount of the upheaval. The upheaval which affected Rámésvaram island doubtless affected the adjoining mainland, and, by upraising the coast, exposed the sandstones, which have been described above as forming a low wall-like cliff bordering the beach as if by a built quay."

A good specimen of a sandstone quay wall is to be seen on the mainland between the great dam and Muntapum; and north of Kílakarai, a town on the coast south-west of Rámésvaram Island, a very perfect wall of sandstone extends for some distance along the shore, in the loose sand covering which many copper coins—Roman, Chola, Pándyan, Dutch, Indo-French, etc., have been found in recent years. The area which intervenes between the fringing coral reef and the sloping shore at Kílakarai, and which is uncovered by water at low tide, is covered by an extensive green carpet formed by a dense growth of *Zoanthi* agglutinated together by damp sand, among which small isolated madrepores live, though periodically exposed to the heat of the sun. That the coral polyps do not die when thus exposed is due, as pointed out by Möbius and confirmed by Walther, to the fact that they secrete during low ebb-tide a great deal of viscid mucus, which covers the whole corallite and protects it from drying up. I have frequently noticed that the massive blocks of *Porites*, *Cæloria*, &c., brought to me by the divers were long after their removal from the sea covered with a slimy secretion, beneath which the polyps were alive, as evidenced by their movements of contraction and expansion.

Opposite the town of Kílakarai there is a wide gap in the reef, through which sailing boats of light draft can pass into the shallow harbour within the reef, on which the force of the leaves is broken. The calcareous alga, *Halimeda opuntia*, forms a thick deposit on the sea bottom, in shallow water, among the coral patches off Kílakarai. This species is, Mr. G. Murray writes to me, "one of the most abundant siphonous algæ in all warm seas Atlantic, Mediterranean, Indian Ocean. It is green when growing, and turns white

when cast up. I have found it in the West Indies forming a thick layer at tide-mark, cast up in bays into which a strong current runs."

Possessing only very superficial geological knowledge, I am unable to deal satisfactorily with the sub-fossil reef at Pámban, which has, however, more recently than Mr. Bruce Foote's report, received full justice from the pen of Dr. Walther.⁷ Commencing, as already stated, near the Rája's bungalow, it forms a wall exposed to a height of 3 or 4 feet above the sandy shore in which it is imbedded, and extending, almost without interruption, for a distance of a quarter of a mile, after which it becomes covered over with loose sand, and is exposed only at intervals. The main mass of this wall, as also of the big detached coral blocks which intervene between it and the sea, and are washed by high tides, is built up of enormous blocks of *Porites*, one of which, isolated from neighbouring blocks, has a diameter of 12 feet. That these blocks are imbedded as they grew is shown not only by their reef-like appearance, but also by their upright position, the vertical columns of many of the blocks bearing testimony to the fact that they have not been cast up by the waves at random, like the big coral fragments which are exposed at low tide, and lie irregularly in all possible unnatural positions. The calices on the surface of the fossil corals are either perfectly distinct over large areas, so as to render their identity certain, or, especially in the case of the blocks which are still exposed to wave action, worn away, or concealed by a crystalline incrustation. Imbedded in cavities in the *Porites*, once bored and occupied by the living mollusc animal, are immense numbers of the shells of the lithodorous *Venerupis carditoides*, which abounds on the living reef at the present day. The *Porites* are frequently capped by *Astræans*, which are also found firmly fixed to their lateral aspect. Less commonly they are incrustated with *Mæandrinæ* (*Cæloria*), which, like the *Astræans*, also form solid isolated blocks, but of far smaller size than the *Porites*. The blocks are, for the most part, covered on their upper surface by a crust of thick compact laminated sand-rock, imbedded within which are the shells of mollusca—*Cardium*, *Arca*, *Turbo*, *Cerithium*, *Spondylus*, *Corbula*, *Trochus*, *Cypræa*, &c. I

⁷ Vide *Verhandlungen der Gesellschaft für Erdkunde zu Berlin*, 1889, No. 7, translated in *Rec. Geol. Surv. Ind.*, vol. xxiii, pt. 3, 1890; and *Petermann's Mitteilungen aus Justus Perthes' Geographischer Anstalt Ergänzungsheft*, No. 102, 1891.

have also found several carapaces of fossil decapod crustacea, whose genus I was unable to identify. At the commencement of the reef, *i.e.*, at the end nearest to the bungalow, the sand-rock is arranged in a succession of layers with a dip seawards, and forms an incrusting layer about 8 inches thick. A little further on the reef has a terraced appearance; an upper terrace being formed by sand-rock horizontally stratified, exposed to a height of 18 inches, and supported by underlying *Porites*, *Astræa*, *Cæloria*, and *Turbinaria*; and a lower terrace formed by a flat-topped mass of *Porites*, about 9 yards in length, covered with loose sand. Not the least interesting feature of the coral wall is the presence of a bank of madrepores, extending over a length of 8 yards at a higher level than the *Porites*, and evidently still placed as they originally grew, their radiating branches spreading outwards from the base, and forming a broad flat surface, which affords support to a thick superjacent layer of consolidated sand-rock. The maximum height of the madrepores above the loose shore sand is 18 inches, and they clearly form a portion of a bank, such as may be seen spreading over considerable areas on the living reef on a calm day.

As one looks out to sea from the Pámban bungalow at low water on a breezy day, three distinct zones can be clearly distinguished, *viz.* :—(1) commencing about three-quarters of a mile from the shore, and extending to the horizon, clear blue water separated by a sharp line of demarcation from (2) a zone discolored by sediment in suspension carried by the current through the Pámban pass. This zone, in which the living corals flourish though washed by a current, sometimes running at the rate of 7 to 8 knots per hour, to which they are exposed, terminates at the sharply defined land face of the reef,⁸ where the corals, constantly bathed by water and never exposed above the surface, act as a natural breakwater which breaks the force of the waves, so that, at high tide, the shallow water between the reef and the shore is smooth. The land face of

⁸ In the third edition of Darwin's *Structure and Distribution of Coral Reefs*, the reefs of the Madras Coast of the Gulf of Manaar and the northern part of Ceylon are not indicated on the map (in which by the way an active volcano is indicated near Negapatam) showing the distribution of coral reefs, because as Professor Bonny says (p. 247) :—"The sea off the northern part of Ceylon is exceedingly shallow, and, therefore, I have not colored the reefs which partially fringe portions of the shores and the adjoining islets, as well as the Indian promontory of Madura."

the reef is made up almost entirely of madrepores, amid a perfect forest of arborescent sea weeds and fleshy alcyonians which, as one rows over the reef on a bright still morning, can be easily recognised as large snow-white patches. Other genera—*Porites*, *Caloria*, *Turbinaria*, etc.—occur in deeper water. (3) There is a zone, about 40 yards in breadth, between the reef and the shore, which is covered by water at high tide, but completely exposed at low tide. It is made up of dead coral blocks, fragments, and débris, among which branches of worn madrepores are most conspicuous, broken off or rolled along from the reef. These blocks and fragments are covered with low-growing clumps of brown and green sea weeds, and enclose shallow pools in which ‘coral fishes’ of brilliant hue may be seen, and colonies of *Cerithia* leaving in their wake a characteristic track. Many of the larger coral blocks are extensively worn by the process of solution, or eroded by boring mollusca and other animals. Among the crevices of the eroded corals various crustacea (*Gonodactylus*, *Pilumnus*, &c.), find a home; and crawling on their surface, which is frequently covered by erect or sessile encrusting sponges, or hidden beneath them, annelids (*Amphinome*, *Nereis*, &c.), and bright-colored planarians may be found.

From the Pámban beach the sea bottom slopes very gradually to a depth of 20 to 26 feet at a distance of three-quarters of a mile from the shore. Between the Kathoo Vallimooni reef, marked on the survey chart as being ‘partially dry at low water spring tides,’ and the spit of mainland which terminates at Point Rámen a boat passage has been carved out by natural processes. North of Rámés-varam island the living coral reef formation is stated by the local fishermen, in answer to independent inquiries by Mr. Bruce Foote and myself, to extend only as far as Pillay Mudum, 7 miles south-east of the Vigai river, which, though easily crossed on foot in the dry season, is in high flood during the monsoon, and, for about a fortnight in the year, impassable even on a raft.

Piled up over a limited area at the base of the fossil reef were masses and fragments of pumice⁹ encrusted with

⁹ “The fragments of pumice thrown up into the ocean during far distant sub-marine eruptions, or washed down from volcanic lands, are at all times to be found floating about the surface of the sea, and there being cast upon the newly formed islet produce by their disintegration the clayey materials for the formation of a soil, the red earth of coral islands.” Murray, Royal Institution, March 16, 1888.

Polyzoa, *Chamæ*, tubes of tubicolous worms, *Balani*, young pearl-oysters, &c. In all probability these fragments were, in the first instance, discharged from the volcano of Krakatoa during the great eruption of 1883. One curious result of that eruption was that, in the district of Charingin, which was depopulated by the tidal wave during the outburst, tigers increased so enormously in number that the Government reward for killing them had been fixed at 200 guilders each.

Washed on shore by the waves, protecting the upper surface of the dead corals, or brought up for me from the sea bottom by my divers, were nodular calcareous algæ, which, from microscopical examination, I find to be identical with those which were dredged off the town of Negombo in Ceylon by Captain Cawne Warren, and reported on by Mr. H. J. Carter.¹⁰ "The specimens," says that authority, "consist of calcareous nodules of different sizes, which may be said to originate, in the first instance, in the agglutination of a little sea bottom by some organism into a transportable mass which, increasing after the same manner as it is currented about, may finally attain almost unlimited dimensions. They are, therefore, compounded of all sorts of invertebrate animals, whose embryos, swimming about in every direction, find them, although still free and detached, of sufficient weight and solidity to offer a convenient position for development, and hence the number of species in and about them. . . . Perhaps no family of organisms has entered into their composition or increased their solidity more than calcareous algæ (*Melobesiæ*) which, in successively laminated or nulliporoid growths, have rendered these nodules almost solid throughout, or covered with short, thick, nulliporiform processes. . . . Next to the part which the *Melobesiæ* have taken in their formation may be mentioned the sessile *Foraminifera*, and these have, in turn, been overgrown, in many instances, by *Polyzoa*."

Specimens have been picked up on shore both by Mr. Bruce Foote and myself of a curious body, the nature of which has given rise to some discussion, and is still and likely to remain *sub judice*. One of them was exhibited at the Linnean Society, and Dr. Anderson and Mr. Dendy were inclined to regard it as possibly the consolidated roe of a fish; whereas Professor C. Stewart was of opinion that

¹⁰ *Ann. Mag. Nat. Hist.*, June, 1880.

it was a vegetable structure; his opinion being based on the examination of microscopical preparations which he demonstrated to me when I was in Europe some time ago.

Among other specimens collected on the Pámban beach I may mention the complex tubular skeletons of the chætopod *Filograna*, and large blocks of drift wood bored by the mollusca *Teredo* and *Parapholas*, the latter of which had destroyed the bottom of the local port gig.

The Indian fin-whale (*Balænoptera indica*), concerning which I overheard a visitor to the Madras museum explaining to his son that it uses the whale-bone as a tooth-brush, has been known to accompany vessels in the gulf of Manaar, and I have seen one close to a steamer in which I was rounding Cape Comorin. It is related that, some years ago, the schooner 'Abdul Ráman,' which was at anchor close to Pámban, was suddenly released from her moorings, and towed out to sea to a distance of several miles by some invisible agent. A few days afterwards the carcass of a whale was cast on shore, and the theory was that this whale was the cause of the involuntary cruise, it having been tempted out of curiosity to examine the ship, in whose grapple it is supposed to have been caught, and to have taken the steamer in tow until it liberated itself. In support of this theory, the ribs and vertebræ of a whale were shown to me in the grounds of the mission bungalow.

The phytophagous Sirenian, *Halicornia dugong* (the dugong), which is said¹¹ to be found in the salt-water inlets of South Malabar, feeding on the vegetable matter about the rocks and basking and sleeping in the morning sun, is according to Emerson Tennent¹² attracted in numbers to the inlet from the Bay of Calpentyn on the west coast of Ceylon to Adam's Bridge by the still water and the abundance of marine algæ in this part of the Gulf of Manaar. It is of an extremely shy disposition, and I have never seen it myself, though I have heard of dead carcasses being thrown up on the Pámban beach, and living specimens being caught in the fishing nets. One was, in fact, caught, together with a young one, the day before my arrival at Pámban in 1889, and promptly sold for food, as it is considered a great delicacy. There is a tradition among the natives that a box of money was found in the stomach of a dugong which was cut up in the Pámban bazar some years ago; and an official

¹¹ Jerdon, *Mammals of India*.

¹² *Ceylon*, vol. ii, 1860.

is now always invited to be present at the examination of the stomach contents, so that the possessors of the carcass may not be punished under the Treasure Trove Act for concealing treasure. But the stomach contents invariably prove to be green sea-grasses (phanerogams) which are very abundant in the shallows of one to three feet in depth on the Ceylon coast of the gulf of Manaar, and almost entirely exclude the sea weeds (algæ). The fat of the dugong is believed to be efficacious in the treatment of dysentery, and is administered in the form of sweetmeats, or used instead of *ghi* (clarified butter) in the preparation of food. The skeleton of a female dugong in the Madras museum shows, encased in the upper jaw, the functionless teeth, the blunt points of which are, during life, covered by a fleshy lip forming a snout. The female is described by Tennent (*op. cit.*) when suckling her young, as holding it to her breast with one flipper, while swimming with the other, holding the heads of both above water, and, when disturbed, suddenly diving and displaying her fish-like tail.

The divers brought me from one of the neighbouring islands a single specimen of the hawk's bill turtle (*Chelone imbricata*), the source of tortoise-shell, and the edible turtle (*Chelone mydas*). The latter I have seen carrying the cirrhiped *Chelonobia testudinaria*¹³ and the pearl-oyster attached by its byssus to the carapace. It is very abundant in the shallow water near the sandy shores of the islands in the vicinity of Rámésvaram, on which the female lays her eggs. A large specimen, whose skeleton has been preserved, was purchased for eight annas on the understanding that the vendor should have the flesh as a perquisite. The process of removal of the edible portions of fat, flesh, and viscera was not a pleasant operation to witness. The victim was placed on its back, and secured by ropes which did not prevent demonstrative flapping of its fins during the operation. The operation, skilfully performed with a carving knife, of removal of the breast-plate displayed the internal organs, which were removed together with their investing fat. The pulsations of the heart, which was removed last of all, the snapping of the jaws, the plaintive expression of the eyes, and general indications of disapproval formed a ghastly spectacle not easily to be forgotten. The flesh of the edible

¹³ I have also seen parasitic pedunculated cirrhipeds attached to the skin of a sea-snake (*Hydrophis*), the gills, of *Neptunus pelagicus*, and the antennæ of *Panulirus dasygus*.

turtle is described by Tennent as being sold piecemeal in the market place at Jaffna, while the animal is still alive, each customer being served with any part selected which is cut off and sold by weight; and Darwin, referring to the gigantic tortoise of the Galapagos Archipelago, says that, when a tortoise is caught, a slit is made in the skin near the tail, so as to see whether the fact under the dorsal plate is thick. If it is not, the animal is liberated, and it is said to soon recover from the minor surgical operation.

A single specimen of the fresh-water tortoise (*Nicoria trijuga*), which I recently heard referred to as a "trot-ice", found at the foot of a tree on the sandy soil outside the town of Pámban, was brought to me for sale. The land snakes of the island are represented, so far as I know, from personal observation, by *Lycodon aulicus* and *Tropidonotus stolatus*, of which the latter bit a friend's native servant in the foot, causing great torture until he was assured that it was not a toxicophidian. Batrachians I have not seen on the island, but the existence of *Rana hexadactyla*, which is, I am told, eaten in the Indo-French possessions, was made evident by the nocturnal concerts in a tank near the bungalow. Frogs are eaten by some of the lowest caste natives in India, and by the Burmese. In the bazárs of Burma boiled frogs are exposed for sale among other articles of food. I have myself seen dried frogs hung up for sale in the Cochin bazár.

One of the edible holothurians ¹⁴ (*trepangs* or *béches-de-mer*) is very abundant in the mud on the south shore at Pámban, and in the vicinity of Rámésvaram, at both which places it is prepared for exportation to Penang and Singapore. The process of preparation, which is not an appetising one to watch, is as follows:—The holothurians are collected as they lie in the mud at low water, and placed in a cauldron which is heated by a charcoal fire. As the temperature rises in the cauldron, the still living animals commit suicide by the convenient process of ejecting their digestive apparatus, &c., and become reduced to empty leathery sacs which, by loss of water consequent on the temperature to which they are exposed, shrivel considerably. At the end of twenty minutes or half an hour the boiling process is stopped, and the shrivelled animals are buried in the sand until the following morning, when the

¹⁴ *Holothuria marmorata*.

boiling process is repeated. Finally, they are arranged according to their size, and are ready for shipment.

Trepangs, of which various kinds are recognised in commerce, are highly esteemed as an article of food by Chinese and Japanese epicures, being made into a thick gelatinous soup. They are said to be a favorite article of diet among the colonists of Manilla, and to make a capital dish when cooked by a European chef.

As regards the question¹⁵ whether holothurians live on living coral or obtain nutriment from swallowing the sand and detrital material, the two most abundant species in the Gulf of Manaar (*H. atra* and *H. marmorata*) live, not on the reef, but on the muddy bottom between the reef and the shore, which is frequently uncovered at low tide. From repeated examination of the contents of their alimentary canal, I have been unable to find any evidence that they have been feeding on living coral, the swallowed materials consisting, for the most part, of sand, coral débris, small mollusca, alcyonian spicules, and sea weeds.

¹⁵ Vide Darwin, *Coral Reefs*, 3rd edition, 1889, p. 20.

II.—LITTORAL FAUNA OF THE GULF OF MANAAR.

THE gulf of Manaar, bounded on the north by Adam's bridge, intervenes between the west coast of Ceylon and the south-east coast of the Madras Presidency. The greatest depth yet found, and recorded by Dr. A. Alcock, when Surgeon-Naturalist to the Marine Survey Steamer 'Investigator,' in the more open part of the gulf, is 1,466 fathoms (temperature 34.8° Fahr.), and the bottom appears to be green mud throughout.

It is earnestly to be hoped that both the littoral and deep-sea fauna of the gulf will some day receive, through the medium of a biological station worked on lines similar to those of the Naples and Plymouth stations, the exhaustive investigation which they richly deserve. The time at my own disposal, and the diffuse work of Museum direction, which necessitates residence in Madras during the greater part of the year, have so far permitted only an occasional flying visit, such as renders any attempt at exhaustive observations wholly out of the question, and I am consequently only able to place on record lists, with some details, of those species which have been obtained by myself from Rámésvaram and the neighbouring islands, from Tuticorin, and, in the case of the crustacea and mollusca, from the Ceylon pearl banks and their vicinity.

My hearty thanks are due for the great assistance which they have rendered in working out my collections, to Mr. A. Dendy (sponges), Dr. Ortmann (corals), Dr. Selenka (gephyrea), Professor Jeffrey Bell (echinoderms), Mr. J. R. Henderson (crustacea), Dr. Von Martens and Mr. E. A. Smith (mollusca) and Mr. R. Kirkpatrick (bryozoa).

PORIFERA.

The sponges recorded below were collected by me either in the neighbourhood of Rámésvaram island or at Tuticorin, and sent to Mr. A. Dendy, at that time on the staff of the British Museum, Natural History, by whom they were described in detail in the *Annals and Magazine of Natural History*, September, 1887, and February, 1889.

As regards the first collection, which was made at Rámés-varam, Mr. Dendy wrote as follows :—" The collection is of exceptional interest, owing to the fact that it is the first which has been obtained from this particular locality. Indeed our knowledge of the sponge-fauna of the entire Indian ocean is extremely deficient. This deficiency is almost certainly due to want of investigation rather than to any actual scarcity of sponges. Mr. Ridley and I have already pointed out, in our report on the Monaxonida collected by H.M.S. Challenger, that 'this little-known field will probably yield a rich harvest to whoever has the good luck to thoroughly investigate it;' and this statement is amply borne out by Mr. Thurston's researches.

"The best known locality for sponges in the Indian Ocean is undoubtedly Ceylon. Bowerbank, Gray, and Carter have all written upon the sponge-fauna of this particular district, and the sponge-fauna of Madras, in so far as is evidenced by the material at my disposal, bears a striking resemblance to it. Thus, out of the ten determinable species from Madras, four, viz., *Halichondria panicea* (a cosmopolitan species), *Axinella donnani*, *Hircinia clathrata*, and *Hircinia vallata*, have already been recorded from the neighbourhood of Ceylon.

"There can be no doubt that the present collection was obtained in shallow or moderately shallow water, although there is no record of the depth. Species with a strong development of spongin in the skeleton-fibre predominate, as might have been safely predicted from the climatic conditions of the locality."

The majority of the sponges, as will be seen, belong to the monaxonida, which "comprise by far the most commonly met with and abundant of all sponges. They occur in greater or less profusion in all parts of the world, but are more especially shallow-water forms. They may be collected between tide-marks almost anywhere."¹⁶

None of the gulf of Manaar sponges, which I have collected from between tide-marks up to 11 fathoms, are of any commercial value.¹⁷ The colours of many of them are very bright, but soon fade or change when the sponge is dried or immersed in alcohol.

¹⁶ Challenger Report on Monaxonida.

¹⁷ A single small specimen of the commercial sponge, *Spongia officinalis*, was collected by Dr. Anderson in the Mergui Archipelago.

The following list includes only a portion of my collection, many of the sponges still awaiting identification. Of the thirty-one species recorded by Mr. Dendy, eighteen (indicated by an asterisk) were described as new species, and two new varieties of previously recorded species, viz., *Pachychalina multiformis* and *Ciocalypta tyleri*, were described.

TETRACTINELLIDA.

- * *Tetilla hirsuta*, Dendy. Tuticorin. Pale yellow with darker centre.

MONAXONIDA.

Halichondria panicea, Johnston, var. *Rámésvaram*. Light pink variety of the British species.

Petrosia testudinaria, Lamarck, sp. Tuticorin pearl banks. Pink, cup-shaped.

- * *Reniera madrepora*, Dendy. Tuticorin. Pink.

- * *Pachychalina multiformis*, Lendenfeld, sp. (var. *manaarensis*, Dendy). Tuticorin. Pale violet, or light pink.

- * „ *delicatula*, Dendy. Tuticorin. Colour not recorded.

- * „ *spinilamella*, Dendy. Tuticorin. Pale yellow.

Siphonochalina communis, Carter, sp. Tuticorin. Bluish brown.

- * *Gelliodes carnosus*, Dendy. Tuticorin. Grey.

Iotrochota baculifera, Ridley (var. *flabellata*, Dendy). *Rámésvaram* and Tuticorin. Dark purple.

Tedania digitata, Schmidt, sp. *Rámésvaram*. Red.

- * *Clathria indica*, Dendy. Tuticorin. Frequently incrusting pearl oyster. Bright red.

- * „ *corallitincta*, Dendy. Tuticorin. Coral-red.

- * *Rhaphidophlus spiculosus*, Dendy. Tuticorin. Vermilion.

- * *Hymeniacion*? *fœtida*, Dendy. Tuticorin. Grey; smells like valerian when dry.

- * *Phakellia ridleyi*, Dendy. *Rámésvaram*. Red.

Ciocalypta tyleri, Bowerbank (var. *manaarensis*). Tuticorin. White.

- * *Acanthella carteri*, Dendy. Tuticorin. Orange.

- * *Auleta aurantiaca*, Dendy. Tuticorin. Orange-red.

Axinella donnani, Bowerbank. *Rámésvaram* and Tuticorin pearl banks. Orange.

- * „ *labyrinthica*, Dendy. Tuticorin. Red.

- * „ *tubulata*, sp. Bowerbank. *Rámésvaram* and Tuticorin pearl banks. Inhabited by commensal tubicolous oligochaete worms. Pinkish-red or red.

- * *Raspailia fruticosa*, *Dendy*. Rámésvaram. Pink.
- * „ *thurstoni*, *Dendy*. Rámésvaram. Dry shore specimens.
- * *Suberites inconstans*, *Dendy*. Between tide-marks. Pámban.
- „ *a* var. *mœandrina*. Brown. Canal system of var. *mœandrina* inhabited by ophiuroids.
- „ β var. *digitata*.
- „ γ var. *globosa*.

CERATOSA.

- * *Spongionella nigra*, *Dendy*. Tuticorin. Black.
- Hippospongia*, sp. Rámésvaram.
- Hircinia clathrata*, *Carter*. Rámésvaram and Tuticorin. Canal system occupied by a cirrhiped crustacean, *Balanus (Acasta) spongites*.
- * „ *vallata*, *Dendy*. Rámésvaram.
- Aplysina purpurea*, *Carter*. Tuticorin. Grey (in spirit, or when dry); dark purple.
- „ *fusca*, *Carter*. Tuticorin.

CÆLENTERATA.

OCTACTINIA.

- Aleyonium digitulatum*, *Klünz*. Rámésvaram.
- „ *gyrosum*, *Klünz*. Rámésvaram.
- „ *polydactylum*, *Ehr.* (var. *mamillifera*, *Klünz*). Rámésvaram.
- Sarcophytum pauciflorum*, *Ehr.* Rámésvaram.
- Echinogorgia pseudosasappo*, *Köll*. Rámésvaram; also from the Madras harbour; studded, as figured by *Esper*, with *Aviculae*, and ophiuroids.
- „ *sasappo*, *Köll*. (*Esper* sp.). Rámésvaram.
- „ *cerea*, *Köll*. Rámésvaram; also from the Madras harbour.
- „ *furfuracea*, *Köll* (*Esper*, sp.). Rámésvaram; also from the Madras harbour.
- Plexaura flabellum*, *Esper*. Horny axes cast on shore at Rámésvaram and Tuticorin.
- Juncella juncea*, *Pallas*. Rámésvaram and Tuticorin (near shore and on pearl banks).
- Gorgonia (Leptogorgia) miniacea*, *M. Edw.* (*Esper*, sp.). Rámésvaram and Tuticorin.
- Gorgonella umbella*, *Esper*. Tuticorin.
- Suberogorgia suberosa*, *Pallas*. Rámésvaram and Tuticorin.
- Corallium nobile*, *Pallas*. Rámésvaram.

Pteroides javanicum, *Bleeker*. Rámésvaram.

„ *esper*i, *Herklots*. Rámésvaram and Tuticorin.

Virgularia juncea, *Esper*. Rámésvaram.

Lituaria phalloides, *Pallas*. Rámésvaram.

Some of the alcyonia formed large, flat, encrusting masses. Entwining their arms round the stems and branches of *Juncella juncea*, *Suberogorgia suberosa*, etc., were delicate ophiuroids (*Ophiothrix*, etc.), and, clinging to the gorgoniæ were the crinoids, *Antedon reynaudi*, *Antedon palmata*, and *Actinometra parvicirra*. Living on the stems of the red-coloured gorgoniæ I several times found the mollusc *Orulum* (*Radius*) *formosus*, the colour of whose shell corresponded with that of the gorgoniæ.

A specimen of *Suberogorgia suberosa*, obtained at Mauritius in 90 fathoms, is described by Ridley (*Ann. Mag. Nat. Hist.*, 1882, p. 132) as “an immense dry specimen 3 feet 5 inches high, and 18 inches in maximum lateral diameter. The colour is pale wainscot to pale rufous-brown; the branches are given off mostly at angles of 30°. The colour, very different from the deep brick-red usual in this species, may perhaps be due to the manner of drying.” The height of a specimen in the Madras museum from Tuticorin, where the pale and brick-red varieties were living side by side, is 4 feet 8 inches, and the maximum lateral diameter 2 feet 2 inches. The specimens of *Gorgonia miniacea* were characterised by the almost constant presence, on the stems or at their bifurcation, of diseased excrescences—the so-called galls—occupied by a cirrhiped crustacean, and perforated by an orifice, through which currents of water for the respiration of the crustacean were admitted into the cavity of the excrescence, through which the stream passed in a constant direction. The association of similar excrescences on stony corals of the genera *Sideropora*, *Seriatopora*, and *Pocillopora*, is discussed in detail by Semper, and I have myself seen a specimen of the cup-shaped *Turbinaria crater* (preserved in the Madras museum), the interior surface of which presents a mammillated appearance caused by hundreds of *Balani*. Several fragments of *Corallum nobile*, the red coral of commerce, have been picked up by me on the Pámban beach, and the native divers tell me that they occasionally come across much larger pieces. Concerning this species Ridley says¹⁹:—“Dr. Lankester

¹⁸ Animal Life. *Internat. Science Ser.*, vol. xxxi.

¹⁹ *Ann. Mag. Nat. Hist.*, vol. xi, 1883.

(Uses of Animals to Man), besides the Persian Gulf, gives Ceylon as a locality for this, the precious red coral of the Mediterranean and Cape Verd Islands, and Dr. Ondaatje has shown me decorticated specimens from Ceylon, which make the identity of the species probable. It is noteworthy that a fossil form is recorded from Indian deposits (Duncan), which, as I have given reasons for thinking (Proc., Zool. Soc., 1882, p. 334), seems probably identified with this species, Seguenza having found it fossil in India, still bearing a slight red tint. 'An officer,' in a work entitled *Ceylon* (London, 8vo., 1876) mentions small fragments of red coral similar to that of the Mediterranean as having been found at the water's edge between Galle and Colombo, and states it to have been referred to by the Portuguese." It must be borne in mind, however, that the red coral of commerce is imported to the east in large quantities to be worked up into necklaces and other ornaments for natives; and it is possible that the small fragments, picked up from time to time on the beach, may be only adventitious products, and not a natural product of the neighbouring sea. The condition of the Indian trade in red coral has been said²⁰ to be an accurate gauge of the condition of the agricultural classes in the North-Western Provinces, Rajputana and Sub-Himalayan tracts, as the bulk of the imports is brought by these classes to be worn as necklaces, the coral beads, when a man is prosperous, alternating with gold beads. The value of the red coral imported into India in the years 1889-92 was Rx. 140,194; Rs. 1,68,716 and Rs. 1,08,112, respectively.

VIRGULARIA JUNCEA.²¹

My attention was directed to an article in the *National Review*, February, 1890, entitled 'Out of the Depths,' by the Honorable A. E. Gathorne-Hardy, who there enters into a discussion of the habits of the genus *Virgularia*. The points at issue are two-fold:—

(1) Do the animals stand up vertically with their bulb planted in the mud?

(2) Can the animals pull themselves in with force so as to nearly or quite disappear?

²⁰ J. E. O'Connor. *Review of Indian Trade*, 1882-83.

²¹ This note was originally published in the *Proc. Zool. Soc., Lond.*, June 17, 1890.

In the first edition of my *Notes on Pearl and Chank Fisheries*, I said with reference to specimens of *Virgularia*: "The Sea-pen, *Virgularia juncea*, accords in its habits with another species, *V. patagonica*, which is described by Darwin (*Journal of Researches*,) as being seen projecting like stubble with the truncate end upwards, a few inches above the surface of the muddy sand. When touched or pulled, they suddenly draw themselves in with force so as to nearly or quite disappear."

The specimens of *V. juncea* were obtained by one of my Labbi divers in shallow water opposite the Kothanda Raman kovil (temple) on Rámésvaram island in July, 1888. His attention was attracted by what he thought was a stick projecting a few inches above the sandy bottom, and he broke it off and gave it to one of my native collectors, who was with him and recognized it as being the broken piece of an animal. The divers then hunted for and secured numerous other specimens, all of which had their terminal bulbs in a perfect condition. The largest specimen was 16 inches in length, and tapered towards the upper end, but the extreme tip was wanting. The diver described the animals as sticking straight up in the sand, and said that, as soon as he touched them, they went deeper and deeper down in the sand, and sometimes fixed themselves so firmly that he could only secure them by digging them out with a spade.

Though I was not present at the capture of the specimens, I had no reason to discredit the evidence of the diver who was a keen observer, wholly unacquainted with the English language, and who had certainly never seen or heard of the *Journal of Researches*.

HEXACTINIA.

ACTINIARIA.

Various undetermined species of sea-anemone are found, either burrowing in the sandy shore between tide-marks, or attached to, or living within cavities excavated in coral blocks. A single specimen of *Palythoa tuberculosa*, recorded by Esper from Tranquebar on the east coast of the Madras Presidency, was brought up by the divers at Pámban, encrusting the upper surface of a dead coral. Various species of *Zoanthus*, single or colonial, live among the corals

on the reefs. At both Tuticorin and Pámban I have several times seen specimens of *Sphenopus marsupialis*, which was collected originally by Johns, a Moravian Missionary, at Tranquebar, and was during the cyclone of 1886 cast on shore in very large numbers at Madras, where it was collected for me by one of my native taxidermists, who reported to me that he found it 'grazing' on the beach. The outer surface of this species is made up of sand grains glued together by a viscid secretion and imbedded in a cartilaginous case. Specimens figured in the *Proceedings of the Zoological Society*, February 14, 1867, were collected at Pulo Faya in the China seas.

MADREPORARIA.

1. MADREPORARIA APOROSA.

Fam. *Turbinolidæ*.

Paracyathus profundus, *Duncan*. (Fauna Mergui).

Fam. *Pocilloporidæ*.

Pocillopora bulbosa, *Ehrbg.*

„ *verrucosa*, *Ell. Sol.*

Fam. *Astræidæ*.

Galaxea bougainvillei, *Blott.*

„ *ellisi*, *M. Ed. and Haime.*

Symphyllia radians, *Val.*

Echinopora aspera, *Ell. Sol.*

„ *flexuosa*, *Verrill.*

„ *lamellosa*, *Esper.*

Leptoria gracilis, *Dana.* var. *tenuis*, *Dana.*

Cœloria arabica, *Klzg.*

„ „ var. *subdentata*, *M. Ed. and Haime.*

„ „ var. *leptotricha*, *Ehrbg.* (= *C. bottai*, *M. Ed. and Haime.*)

Hydnophora contignatio, *Försk.* (= *H. Ehrenbergi*, *M. Ed. and Haime.*)

„ *lobata*, *Lmk.*

„ *microconus*, *Lmk.*

Favia clouei, *Val.*

„ *denticulata*, *Ell. Sol.*

„ cf. *tubulifera*, *Klzg.*

Goniastræa halicora, *Ehrbg.*

„ *retiformis*, *Lmk.*

- Prionastræa tesserifera, *Ehrbg.*
 Plesiastræa, cf. versipora, *Lmk.*
 Phymastræa, n. sp., *Ortm.*
 ,, profundior, *M. Ed. and Haime.*
 ,, valenciennesi, *M. Ed. and Haime.*
 Cyphastræa mülleri, *M. Ed. and Haime.*
 ,, serailia, *Försk.*
 Merulina ampliata, *Ehrbg.*

II. MADREPORARIA FUNGIDA.

Fam. Plesiofungidæ.

- Siderastræa savignyana, *M. Ed. and Haime.* Identical with
 S. sphæroidalis, *Ortm.* (steinkor, v.
 Ceylon), which is only another form
 of growth.
 Tichoseris obtusata, *Quelch.*

Fam. Cycloseridæ.

- Cycloseris cyclolites, *Lmk.*

III. MADREPORARIA PERFORATA.

Fam. Eupsammidæ.

- Cœnopsammia ehrenbergiana, *M. Ed. and Haime.*
 Heteropsammia cochlea, *Spengler.*

Fam. Madreporidæ.

- Madrepora corymbosa, *Lmk.*
 ,, erythræa, *Klzg.*
 ,, formosa, *Dana.*
 ,, multiformis, *Ortm.*
 ,, plantaginea, *Lmk.*
 ,, cf. secunda, *Dana.*
 Turbinaria crater, *Pall.*
 ,, ,, var. quincuncialis, *Ortm.*
 ,, mesenterina, *Lmk.* var. cinerascens, *Ell. Sol.*
 ,, peltata, *Esp.*
 Astreopora pulvinaria, *Lmk.*
 Montipora exserta, *Quelch.*
 ,, foliosa, *Pall.*
 ,, spongiosa, *Ehrbg.*
 ,, stylosa, *Ehrbg.*

Fam. *Poritidæ*.

Porites columnaris, *Klbg.*

„ *lutea*, *M. Ed. and Haime.*

„ *solida*, *Försk.*

Goniopora pedunculata, *Quoy and Gaim.*

The majority of these stony corals belong to the class of "reef corals," but a few species are included, e.g., *Paracyathus profundus*, *Cycloseris cycloites*, and *Heteropsammia cochlea*, which were dredged in deep water, where the reef-builders were absent, and the young *Fungia*, which were dredged from the muddy bottom of the Pámban Pass. All the specimens of *Heteropsammia cochlea* exhibited a hole bored by a sipunculid worm (*Aspidosiphon*),²² which is always found living within this coral. It is difficult, as Semper points out,²³ to understand what advantage each animal can derive from their association; yet some must exist, for a coral is never found without a worm.

The fact is drawn attention to by Dr. Martin Duncan, in his report²⁴ on the madreporaria of the Mergui Archipelago collected by Dr. Anderson, as being very remarkable that "the coral-fauna of Ceylon, so far as it is known from Mr. Stuart O. Ridley's researches, does not contain a single Mergui species. The number of genera common to the two areas is, however, great, and many species are closely allied." A comparison of the list of species recorded above from the Indian side of the gulf of Manaar with those of Dr. Duncan (Mergui),²⁵ Dr. Ortmann²⁶ and Mr. Ridley²⁷ (Ceylon) shows, as might be expected, that some of the species are common to the Indian coast of the gulf of Manaar and Ceylon, and others to the Indian coast of the gulf of Manaar and the Mergui archipelago.

I have found no representative of the hydrocorallinæ on the coral reefs, but *Millepora dichotoma* has been recorded by Ridley (loc. cit) from Ceylon.

The genus *Heliopora* is apparently not represented on the living reef, but a single specimen of *Heliopora edwardsana* has been described from the cretaceous deposits of the

²² See note on commensal sipunculid inhabiting the genus *Heteropsammia*, by G. H. Fowler, Q.J.M.S., No. CXX, Feb. 1890, pp. 412-13.

²³ *Animal Life. Internat. Science Ser.*, 1881.

²⁴ *Journ. Linn. Soc.*, Nov. 13, 1886.

²⁵ *Faun. Mergui. Archipelago*, vol. i, 1889.

²⁶ *Zoologisch Jahrbuch, Spengel*, vol. iv, 1889.

²⁷ *Ann. Mag. Nat. Hist.*, Ser. 5, vol. xi, 1883.

Trichinopoly district of the Madras Presidency, concerning the coral-beds of which Stoliczka writes :—²⁸ “The conditions of the deposits were not so quiet that we could expect to find any of the alcyonaria or of the malacodermata preserved, but the sclerodermata or madreporaria are represented by fifty-seven species, namely, fifty-three belonging to the *aporosa*, three to the *perforata*, and one to the *tabulata*. Looking at the whole fauna we see the reef-building *Astræidæ*, *Stylinidæ*, and *Thamnastræidæ* much exceeding the other families in numbers of species, as well as in frequency of occurrence of specimens. Coral reefs appear to have been of considerable extent, particularly along the old shores within the Ootatoor group; in the two other groups they were much more local.”

The method employed by me for the preservation of corals (*i.e.*, the skeletons) which I reserve for exhibition, is to expose them to the action of the sun and ants, which remove a large amount of the animal matter, and send them in boxes, surrounded by paper and tightly packed in rice-husk, by native sailing boat to Madras. But, however great the care which is taken, it generally happens that some of the corals become covered with mould during the voyage. The rice-husk, which is usually found clinging to the surface of the corals, is removed with a syringe, and the corals, after being submitted to repeated washings with fresh-water, are finally dried in the sun. In no case are they submitted to the action of corrosive alkali solutions. It has been objected, with regard to the preservation of corals by exposing them for some time to the action of rain or running water, that the finest details of the skeleton are liable to be dissolved away to some extent by the action of the carbonic acid in the water. But I found, on my visit to Rámésyaram island in 1889, when enormous numbers of a species of beetle were busily engaged in heaping up finely divided sand between the branches of my rejected madrepores, that the structural details of various delicate corals (*Astræopora*, *Cyphastræa*, *etc.*), which I had left discarded on the sand in the grounds of the bungalow twelve months previously, were to no appreciable extent damaged for purposes of identification, though they had, in the interval, been freely exposed to the action of a heavy monsoon and a cyclone. I am told that the corals rejected by me, as being too

²⁸ *Palæont. Ind. Cretaceous Fauna of Southern India.*

numerous for transport to Madras, have been a source of income to my divers, who offer them for sale to stray visitors to the island.

HYDROIDA.

Plumularidæ.

- Halicornaria bipinnata.* Muttuwartu par, Ceylon.
 „ *insignis*, *Allman*. Muttuwartu par, Ceylon.
 „ *saccaria*, *Allman*. Muttuwartu par, Ceylon.

Campanularidæ.

- Campanularia juncea*, *Allman*. Abundant on east Chéval par, Ceylon.

ECHINODERMATA.

A report on a collection of echinoderms, which I made in the years 1886-87 at Rámésvaram island and Tuticorin, by Prof. F. Jeffrey Bell, was published in the *Proceedings of the Zoological Society*, June 19, 1888, wherein the writer states that "I may be allowed to remind the student of the recent appearance of a memoir on the echinoderm-fauna of the Island of Ceylon.²⁹ Shortly after the distribution of that memoir my respected correspondent, M. de Loriol, was kind enough to write and tell me of four other species of Echinoids, all of which had been collected at Aripo by M. Alois Humbert." Of these four species (*Phyllacanthus annulifera*, *Temnopleurus reynaudi*, *Clypeaster humilis*, and *Laganum depressum*), *C. humilis* and *L. depressum* have been found by me off the Indian coast of the Gulf of Manaar.

Only two new species have been discovered among my collections, viz., an ophiuroid, *Pectinura intermedia*, and an asteroid, *Oreaster (Pentaceros) thurstoni*, of which the latter is a very common shallow-water species, very variable both in its characters and colour. Since the publication of Prof. Bell's report several species, not recorded there, have been found in my subsequent visits to the gulf of Manaar, bringing the total number up to sixty-one.

The majority of the specimens were found in shallow water near the shore, but some, e.g., *Oreaster (Pentaceros) lincki*, *Linckia lævigata*, *Colochirus quadrangularis*, and *Astrophyton claratum* (of which a single imperfect specimen

²⁹ *Scientific Transactions of the Royal Dublin Society* (2), III, p. 643 et seq.

was found within the cup of a *Turbinaria*) were brought up by divers from the pearl banks in ten to eleven fathoms.

Of the six species of echinoid which are described by Agassiz, in his 'Revision of the Echini' as being characteristic of his Indo-African Region, which includes the Madras coast, five, viz., *Echinodiscus auritus* and *biforis*, *Salmacis sulcata* and *bicolor*, and *Echinolampus oviformis*, are very abundant in the gulf of Manaar. But I have not as yet found the sixth species, *Echinodiscus lævis*.

The fossil echinodermata, as recorded in the *Palæontologia indica* from the cretaceous deposits in South India, are represented by two or three species of crinoidea (*Pentacrinus* and *Marsupites*), a single species of asteroid (*Ophiura? cuniffæi*), and thirty-eight species of echinoidea, of which the genera *Cidaris* and *Hemiaster* are most largely represented.

CRINOIDEA.

Antedon cumingi. Tuticorin.

„ *palmata*, Müll. sp. Pámban and Tuticorin. In crevices of coral or on *gorgoniæ*.

„ *reynaudi*, Müll. sp. Pámban. On stems of *gorgoniæ*.

Actinometra parvicirra, Müll. sp. Tuticorin. On stems of *gorgoniæ*.

ASTEROIDEA.

Astropecten hemprichii, M. Tr. Pámban. A specimen in the Madras Museum has swallowed a mollusc, *Cerithium*.

„ *polyacanthus*, M. Tr. Pámban.

Luidia hardwickii, (Gray), Perrier. Pámban.

„ *maculata*, M. Tr. Pámban.

Goniodiscus granuliferus, (Gray), Perrier. Pámban.

Anthenea acuta, Perrier. Pámban.

„ *pentagonula*, (Imk.), Perrier. Pámban.

Pentaceros muricatus, Linck. Tuticorin pearl banks.

„ *superbus*, Möbius. sp. Tuticorin.

„ *thurstoni*, Bell. sp. Pámban, Tuticorin.

Asterodiscus elegans, Gray. Tuticorin.

Asterina cepheus, (M. Tr.), V. Mart. Pámban.

Linckia miliaris, (Linck), V. Mart. Tuticorin pearl banks.

Nardoa novæ caledoniæ, Perrier. sp. Tuticorin.

Echinaster purpureus, (Gray), Bell. Tuticorin.

OPHIUROIDEA.

- Pectinura gorgonia*, *Ltk.* Pámban.
 „ *intermedia*, *Bell.* Pámban.
 „ *infernalis*, *Ltk.* Tuticorin.
Ophiactis savignii, *Aud.* Pámban. In canal system of sponge
Suberites inconstans.
Ophionereis dubia, *Lym.* Tuticorin.
Ophiocoma erinaceus, *M. Tr.* Pámban.
Ophiothrix longipeda, *M. Tr.* Pámban
 „ *neroidina*, *M. Tr.* Pámban.
 „ *aspidota*, *M. Tr.* Pámban.
Ophiomaza cacaotica, *Lym.* Pámban.
Astrophyton clavatum, *Lym.* Tuticorin pearl banks.

ECHINOIDEA.

- Phyllacanthus baculosa*, *A. Ag.* Tuticorin.
Echinometra lucunter, *Leske.* Tuticorin.
Stomopneustes variolaris, *Imk.* Pámban.
Pseudoboletia maculata, Tuticorin.
Temnopleurus toreumaticus, *Leske.* Pámban.
Salmacis bicolor, *Ag.* Tuticorin pearl banks.
 „ *dussumieri*, *Ag.* Pámban. Common in fishing
 nets at Madras.
 „ *sulcata*, *Ag.* Tuticorin.
Echinus angulosus, *Ag.* Pámban. (Spines quite white).
Toxophneustes pileolus, *Ag.* Tuticorin.
Fibularia volva, *Ag.* Pámban.
Clypeaster humilis, *Ag.* Tuticorin pearl banks.
Laganum decagonale, *Less.* Pámban.
 „ *depressum*, *Less.* Pámban.
Echinodiscus biforis, *Ag.* Tuticorin.
 „ *auritus*, *Leske.* Pámban.
Echinolampas oviformis, *Gray.* Pámban.
Lovenia elongata, *Gray.* Pámban.
Rhinobrissus pyramidalis, *Ag.* Pámban.
Brissus unicolor, *Leske.* Pámban.
Metalia sternalis, *Imk.* Tuticorin.

HOLOTHUROIDEA.

- Cucumaria semperi*, *Bell.* Pámban.
Colochirus quadrangularis, *Less.* Tuticorin pearl banks.
Actinocucumis difficilis, *Bell.* Pámban.
Haplodactyla australis, *Semper.* Tuticorin.
Holothuria atra, *Jäger*, Pámban.
 „ *marmorata*, *Jäger.* Pámban (edible trepang).
 „ *monacaria*, *Less.* Pámban.
 „ *vagabunda*. *Selenka.* Tuticorin.

Synapta recta, *Semper*? Pámban.

Thyone sacellus, *Silenka*. A specimen in the Madras museum shows the tentacles, teeth, etc., which were ejected during life.

GEPHYREA.

I. GEPHYREA CHÆTIFERA.

Thalassema formulosum.

II. GEPHYREA ACHÆTA.

Phascolosoma pellucidum, *Keferstein*.

Dendrostoma signifer, *Selenka* and *de Man*.

Sipunculus robustus, *Keferstein*.

Of these four species, dredged off Rámésvaram island, only *Dendrostoma signifer* was abundant.

CRUSTACEA.

As regards the decapod and stomatopod crustacea Mr. J. R. Henderson writes to me:—"This collection is one of the most important which has ever been formed on the Indian coast. It contains about a hundred and sixty species, not more than ten or twelve of which are new to science; but a number of rare or little-known forms are present, and the geographical distribution of most of these has been greatly extended by their discovery on the South Indian shores. Upwards of three hundred species of decapod and stomatopod Crustacea have been recorded from the Bay of Bengal, which may be conveniently held to include the coasts from Ceylon on the one side to Singapore on the other, along with the numerous groups of islands situated within this area. Yet, with the exception of a small collection from Madras report on by Prof. Heller in the Crustacea of the *Reise der Novara*, our knowledge of the species which inhabit the Indian coast proper is limited to a few scattered papers, and to those forms recorded by the older writers under the somewhat vague localisation 'Indian Seas.'

"The crustacean fauna of the Gulf of Manaar shows, as might be expected, a considerable proportion of coral reef species—widely distributed forms, which occur in suitable localities throughout the vast Indo-Pacific region."

An account of the decapod and stomatopod crustacea collected by myself off both the Madras and Ceylon coasts

of the gulf of Manaar has been included by Mr. Henderson in his recent 'Contribution to Indian Carcinology,'³⁰ to which I am indebted for the following list of species, which includes several species (indicated by an asterisk) recorded as new.

Pámban and Tuticorin are on the western or Madras side of the gulf, and Silavaturai and the Cheval and Muttuwartu pars (pearl banks) on the eastern or Ceylon side of the gulf.

DECAPODA.

BRACHYURA.

- Oncinopus aranea, *De Haan*. Muttuwartu.
 Huenia Proteus, *De Haan*. Pámban, Tuticorin.
 Simocarcinus simplex (*Dana*.) Tuticorin.
 Menœthius monoceros (*Latr.*) Pámban, Tuticorin, Muttuwartu, Silavaturai.
 Doclea hybrida (*Fabr*) Pámban.
 Stenocionops cervicornis. (*Herbst.*) Tuticorin.
 Hyastenus Pleione (*Herbst.*) Silavaturai.
 „ Hilgendorfi, *De Man*. Pámban, Tuticorin, Cheval.
 Chlorinoides Coppingeri, *Haswell*. Muttuwartu.
 Naxia hirta (*A. Milne Edw.*) Tuticorin.
 Schizophrys aspera (*Milne Edw.*) Pámban, Tuticorin.
 Micippa Philyra (*Herbst.*) Pámban, Tuticorin.
 „ Thalia (*Herbst.*) Pámban, Tuticorin, Muttuwartu.
 Tylocarcinus styx (*Herbst.*) Pámban, Tuticorin, Muttuwartu.
 Lambrus contrarius (*Herbst.*) Tuticorin.
 „ affinis, *A. Milne Edw.* Pámban, Tuticorin.
 „ longispinus, *Miers*. Tuticorin.
 „ Holdsworthi, *Miers*. Tuticorin.
 „ hoplonotus, *Ad & White*. Muttuwartu.
 Zebrida Adamsii, *White*. Tuticorin.
 Paratymolus sexspinosus, *Miers*. Tuticorin.
 Atergatis integerrimus (*Lmk.*) Pámban, Tuticorin.
 „ floridus (*Rumph.*) Pámban, Tuticorin.
 „ lævigatus, *A. Milne Edw.* Tuticorin.
 Carpilodes tristis, *Dana*. Muttuwartu.
 „ margaritatus, *A. Milne Edw.* Pámban, Tuticorin.
 Liomera punctata (*Milne Edw.*) Tuticorin, Muttuwartu.
 Lophactæa granulosa (*Rüpp.*) Pámban, Tuticorin.
 „ semigranulosa (*Heller.*) Pámban, Muttuwartu.
 * „ fissa, *Henderson*. Tuticorin.
 Actæa granulata (*Aud.*) Pámban, Tuticorin, Cheval.

³⁰ *Trans. Linn. Soc. Zoology*, vol. v, part 10, 1893.

- Actæa calcuosa* (*Milne Edw.*) Tuticorin, Muttuwartu.
 „ *nodulosa* (*White*). Tuticorin.
 * „ *Peronii* (*Milne Edw.*) var. *squamosa*. Muttuwartu.
 „ *rufopunctata* (*Milne Edw.*) Tuticorin, Cheval.
 „ *Ruppellii* (*Krauss.*) Pámban, Tuticorin.
 * *Hypocoelus rugosus*, *Henderson*. Tuticorin.
Euxanthus melissa (*Herbst.*) Tuticorin.
Polycremnus ochtodes, *Herbst.* Muttuwartu.
 * *Halimede Thurstoni*, *Henderson*. Tuticorin.
Cycloxanthus lineatus, *A. Milne Edw.* Tuticorin.
Lophozozymus Dodone (*Herbst.*) Pámban, Tuticorin,
 Muttuwartu.
 „ *cristatus*, *A. Milne Edw.* Muttuwartu.
Chlorodius niger (*Försk.*) Pámban, Tuticorin, Muttuwartu.
Chlorodopsis spinipes (*Heller.*) Muttuwartu.
Leptodius exaratus, (*Milne Edw.*) Pámban, Tuticorin,
 Silavaturai.
Etisus loevimanus, *Randall*. Pámban, Tuticorin.
Phymodius monticulosus (*Dana.*) Tuticorin.
Cymo Andreossyi (*Aud.*) Pámban, Tuticorin.
Menippe Rumphii (*Fabr.*) Pámban, Tuticorin.
Actumnus setifer (*De Haan.*) Muttuwartu.
 * „ *verrucosus*, *Henderson*. Tuticorin, Muttuwartu.
Pilumnus vespertilio (*Fabr.*) Pámban, Tuticorin.
 „ *labyrinthicus* *Miers*. Pámban.
Trapezia Cymodoce (*Herbst.*) Pámban, Tuticorin, Muttuwartu.
 „ *rufopunctata* (*Herbst.*) Tuticorin.
Tetralia glaberrima (*Herbst.*) Pámban, Tuticorin, Muttuwartu.
Eriphia loevimana *Latr.* Pámban, Tuticorin.
Neptunus pelagicus (*Linn.*) Tuticorin.
 „ *gladiator* (*Fabr.*) Pámban.
 „ *sanguinolentus* (*Herbst.*) Pámban.
 „ *armatus*, *A. Milne Edw.* Pámban.
 „ *Sieboldi*, *A. Milne Edw.* Muttuwartu.
Thalamita prymna (*Herbst.*) Pámban, Tuticorin.
 „ *admete*, (*Herbst.*) Pámban.
 „ *Savignyi* *A. Milne Edw.* Pámban, Tuticorin.
 „ *sima*, *Milne Edw.* Tuticorin.
 „ *integra*, *Dana*. Pámban, Tuticorin.
 „ *sexlobata*, *Miers*. Tuticorin.
Goniosoma cruciferum (*Fabr.*) Tuticorin.
 „ *natator* (*Herbst.*) Pámban.
 „ *annulatum* (*Fabr.*) Pámban, Tuticorin.
 „ *Hellerii*, *A. Milne Edw.* Pámban, Tuticorin.
 „ *orientale* (*Dana.*) Tuticorin.
Lissocarcinus loevis, *Miers*. Tuticorin.
Kraussia nitida, *Stm.* Tuticorin.
Cardisoma carnifex, (*Herbst.*) Tuticorin.
Ocypoda ceratophthalma (*Pallas.*) Pámban, Tuticorin.

Ocypoda macrocera, *Milne Edw.* Pámban, Tuticorin.

„ platytarsis, *Milne Edw.* Pámban.

„ cordimana, *Latr.* Tuticorin.

Gelasimus annulipes, *Latr.* Pámban, Tuticorin.

Macrophthalmus depressus, (*Rüpp.*) Pámban.

Scopimera myctiroides (*Milne Edw.*) Tuticorin.

Metograpsus messor (*Forsk.*) Pámban, Tuticorin.

Grapsus strigosus (*Herbst.*) Pámban, Tuticorin.

„ maculatus (*Catesby.*) Tuticorin.

Leiolophus planissimus (*Herbst.*) Pámban.

Sesarma quadrata (*Fabr.*) Tuticorin.

Elanophthalmus pinnotheroides, *White.* Pámban.

Elanene truncata, *A. Milne Edw.* Silavaturai.

Calappa hepatica (*Linn.*) Pámban, Tuticorin.

„ gallus (*Herbst.*) Pámban, Tuticorin.

Matuta victrix, *Fabr.* Tuticorin.

„ Miersii, *Henderson.* Tuticorin.

Leucosia craniolaris (*Linn.*) Pámban, Muttuwartu.

Pseudophilyra Melita, *De Man.* Muttuwartu.

Philyra scabriuscula (*Fabr.*) Pámban, Tuticorin.

„ Adamsii, *Bell.* Pámban, Silavaturai.

„ platycheira, *De Haan.* Silavaturai.

„ globosa (*Fabr.*) Pámban, Tuticorin.

Myra fugax (*Fabr.*) Pámban.

Ebalia Pfefferi, *De Man.* Muttuwartu.

* „ fallax, *Henderson,* Muttuwartu.

Nursia plicata (*Herbst.*) Pámban.

„ abbreviata, *Bell.* Pámban, Silavaturai.

Dorippe dorsipes (*Linn.*) Pámban, Silavaturai.

„ facchino (*Herbst.*) Pámban, Tuticorin.

ANOMURA.

Dromidia unidentata (*Rüpp.*) Tuticorin.

„ australiensis, *Haswell.* Silavaturai.

Cryptodromia pentagonalis, *Hilg.* Silavaturai, Muttuwartu.

Pseudodromia integrifrons, *Henderson.* Tuticorin.

* Raninoides serratifrons, *Henderson.* Cheval.

Hippa asiatica, *Milne Edw.* Pámban.

Albunea symnista (*Linn.*) Pámban.

* „ Thurstoni, *Henderson.* Cheval.

Coenobita rugosa, *Milne Edw.* Pámban, Tuticorin, Silavaturai.

Diogenes Diogenes (*Herbst.*) Pámban, Tuticorin.

„ merguiensis, *De Man.* Muttuwartu.

„ miles (*Herbst.*) Pámban, Silavaturai.

„ custos (*Fabr.*) Pámban.

* „ planimanus, *Henderson.* Pámban.

„ avarus, *Heller.* Pámban, Tuticorin.

* „ costatus, *Henderson.* Pámban, Tuticorin.

- Pagurus punctulatus* (*Oliv.*) Pámban, Tuticorin.
 „ *deformis*, *Milne Edw.* Pámban, Tuticorin.
 „ *varipes*, *Heller.* Tuticorin, Muttuwartu.
 „ *setifer*, *Milne Edw.* Tuticorin.
 * *Troglopagurus manaarensis*, *Henderson.* Tuticorin, Muttu-
 wartu.
Aniculus aniculus (*Fabr.*) Tuticorin, Muttuwartu.
 „ *strigatus* (*Herbst.*) Tuticorin.
Clibanarius padavensis, *De Man.* Pámban, Tuticorin.
 „ *arethusa*, *De Man.* Pámban, Muttuwartu.
 * *Eupagurus zebra*, *Henderson.* Muttuwartu
Petrolisthes dentatus (*Milne Edw.*) Pámban, Tuticorin, Muttu-
 wartu.
 „ *Boscii* (*Aud.*) Pámban, Muttuwartu.
 „ *militaris* (*Heller*) Pámban, Cheval, Muttuwartu.
Porcellanella triloba, *White.* Pámban.
Polyonyx obesulus, *Miers.* Pámban, Tuticorin.
 „ *tuberculosus*, *De Man*, Pámban, Cheval.
Galathea elegans, *White.* Tuticorin.
 „ *spinosirostris*, *Dana.* Muttuwartu.
Munida spinulifera, *Miers.* Muttuwartu.

MACRURA.

- Gebiopsis Darwinii*, *Miers.* Pámban, Tuticorin, Cheval.
Thenus orientalis (*Fabr.*) Muttuwartu.
Panulirus dasyopus (*Latr.*) Silavaturai.
Alpheus Edwardsii (*Aud*) Pámban, Tuticorin, Muttuwartu.
 „ *hippothoë*, *De Man.* Pámban.
 „ *frontalis*, *Say.* Tuticorin.
 „ *lœvis*, *Randall.* Pámban, Tuticorin.
 „ *Neptunus*, *Dana*, Pámban.
Rhynchocinetes rugulosus, *Stm.* Tuticorin
Pontonia tridacnæ, *Dana.* Pámban, Tuticorin.

STOMATOPODA.

- Lysiosquilla maculata*, (*Fabr.*) Tuticorin.
Squilla nepa, *Latr.* Tuticorin.
 „ *affinis*, *Bertho'd.* Tuticorin.
 „ *scorpio*, *Latr.* Tuticorin.
 „ *raphidea*, *Fabr.* Pámban.
Pseudosquilla ciliata (*Fabr.*) Pámban.
Gonodactylus glaber, *Brooks.* Pámban, Tuticorin, Silavaturai.
 „ *Demanii*, *Henderson.* Pámban.

CAPRELLIDÆ.

Several specimens of *Paradeutella bidentata*, Mayer, were found adhering to the stems of *Juncella juncea* on the

Pámban reef. A male was sent to the Naples zoological station for identification by Dr. Paul Mayer, who reported it as being 1 m.m. longer than the longest specimen in his possession.

The type specimens, described by Dr. Mayer,³⁰ were collected by the Swedish Naturalist, K. Fristedt at Pámban, together with *Metaprotella haswelliana*, Mayer; *Metaprotella excentrica*, Mayer; and *Metaprotella problematica*, Mayer, in 1—4 fathoms on bryozoa and sponges.

MOLLUSCA.

The following list of mollusca, which I have collected off both the Indian and Ceylon coast of the gulf of Manaar, includes (1) those which were collected on the beach, all shells which were worn and bore evidence of having been rolled in from a distance being rejected, and only those which appeared to be fresh being retained; (2) those which were obtained by dredging, and straining the contents of the dredge through sieves; (3) those which were collected on the coral reefs on clear days or at low tide; (4) those which were brought up from the pearl banks and other localities by native divers; (5) those which were obtained by examining the sweepings from the kottus (oyster-sheds) during the pearl fishery; (6) those which were found attached to algæ and gorgoniæ, or obtained by breaking up coral blocks with a crowbar, and extracting the shells which were buried in cavities bored by the animals during life.

Pámban, Kilakarai, and Tuticorin are on the western or Madras side of the gulf of Manaar; Dutch bay, Silavaturai, and the Muttuwartu, Cheval and Karaitivu pars (pearl-banks) are on the eastern or Ceylon side of the gulf.

CEPHALOPODA.

Spirula Peronii, Lmk. Pámban, Kilakarai, Dutch Bay,
Karaitivu.
Nautilus pompilius, Linn. Pámban.

PTEROPODA.

Styliola acicula. Pelagic over coral reefs.

³⁰ *Faun und Flor. Golf. v. Neapel. Mon. XVII, pp. 29, 30.*

HETEROPODA.

- Ianthina affinis*, *Rv.* Muttuwartu.
 „ *africana*, *Rv.* Very abundant, coincidently with
Physalia, one evening at Kilakarai.

GASTROPODA.

- Murex anguliferus*, *Lmk.* Tuticorin.
 „ „ var. *ponderosus*. Muttuwartu.
 „ *badius* (?), *Rv.* Pámban, Tuticorin.
 „ *haustellum*, *Linn.* Pámban, Tuticorin.
 „ *palmyferus*, *Sow.* Karaitivu.
 „ *tenuispina*, *Lmk.* Pámban.
 „ *ternispina*, *Lmk.* Pámban.
Fusus colus, *Linn.* Pámban.
 „ *tuberculatus*, *Lmk.* Pámban.
Melongena vesperilio, *Lmk.* Pámban.
Polia rubiginosa, *Rv.* Pámban.
Tritonidea melanostoma, Tuticorin, Cheval.
 „ *undosa*, *Linn.* Pámban.
Pleurotoma tigrina, *Lmk.* Pámban.
 „ (*Drillia*) *crenularis*, *Lmk.* Pámban.
 „ („) *inconstans*, *Smith.* Pámban.
 „ (*Surcula*) *javana*, *de Boiss.* Pámban.
Daphnella varicifera, *Pease.* Muttuwartu.
Cythara pallida, *Rv.* Pámban, Tuticorin.
Clathurella lemniscata, *Nevill.* Pámban.
 „ *rubroguttata*, *H. Ad.* Pámban, Tuticorin.
Mangelia Fairbanki, *Nevill.* Dutch Bay.
Triton chlorostomus, *Lmk.* Pámban.
 „ *cingulatus*, *Pf.* Tuticorin,
 „ *retusus*, *Lmk.* Tuticorin.
 „ (*Persona*) *cancellinus*, *de Boiss.* Tuticorin.
Tritonium cingulatum, *Lmk.* Pámban, Cheval.
 „ *lampas*, *Linn.* Pámban.
 „ *pileare*, *Linn.* Pámban.
Ranella foliata, *Brod.* Tuticorin.
 „ *granifera*, *Lmk.* Pámban, Cheval.
 „ *pusilla*, *Brod.* Muttuwartu.
 „ *tuberculata*, *Brod.* Pámban.
Hindsia acuminata, *Rv.* Tuticorin.
Bullia melanoides, *Desh.* Pámban.
Nassa canaliculata, *Lmk.* Pámban.
 „ *coronula*, *A. Ad.* Karaitivu.
 „ *cribraria*, *Marrat.* Tuticorin.
 „ *delicata*, *Rv.* Muttuwartu.
 „ *fasciata*, *Quoy & Gaim.* Tuticorin.
 „ *marginulata*, *Lmk.* Pámban, Tuticorin, Dutch Bay.

- Nassa marginulata* var. *minor*. Pámban.
 „ „ var. *conoidalis*. Pámban, Kilakarai,
 Karaitivu.
 „ *ornata*, *Kien*. Pámban.
 „ *suturalis*, *Lmk*. Pámban.
 „ *thersites*, *Brug*. Pámban, Tuticorin, Karaitivu.
 „ (*Niotha*) *albescens*, *Dunk*. Pámban.
 „ („) *australis*, *A. Ad*. Pámban.
Eburna spirata, *Lmk*. Pámban
 „ *zeylanica*, *Lmk*. Pámban.
Purpura carinifera, *Lmk*. Pámban.
 „ *Rudolphi*, *Lmk*. Pámban.
Ricinula undata, *Chemn*. Pámban, Kilakarai.
Olivancillaria nebulosa, *Lmk*. Pámban, Tuticorin.
Oliva candida, *Lmk*. Pámban.
 „ *gibbosa*, *Born*. Pámban.
 „ *ispidula*, *Linn*. Pámban.
Ancillaria fulva, *Swains*. Muttuwartu.
 „ *oryza*, *Rv*. Tuticorin, Kilakarai.
 „ (*Sparella*) *acuminata*, *Sow*. Pámban.
 „ („) *ampla*, *Gm*. Pámban, Tuticorin, Cheval.
 „ („) *cinnamonea*, *Lmk*. Tuticorin.
Fasciolaria filamentosa, *Chemn*. Pámban.
 „ *trapezium*, *Linn*. Pámban.
Tudicla spirillus, *Lmk*. Pámban.
Latirus microstomus, *Kob*. Muttuwartu.
 „ *pulchellus*, *Rv*. Karaitivu.
 „ *turritus*, *Gm*. Karaitivu.
Turbinella cornigera, *Lmk*. Tuticorin.
 „ *pyrum*, *Lmk*. Pámban, Tuticorin.
 „ *rapa*, *Lmk*. Tuticorin.
Voluta interpuncta, *Martyn*. Tuticorin.
Cymbium indicum, *Gm*. Pámban.
Mitra duplicata, *Rv*. Pámban.
 „ *rubricata*, *Rv*. Pámban.
 „ *zebuensis*, *Rv*. Muttuwartu.
Strigatella litterata, *Lmk*. Pámban.
Marginella angustata, *Sow*. Pámban, Tuticorin, Cheval,
 Karaitivu.
 „ *dens*, *Rv*. Tuticorin, Dutch Bay, Muttuwartu.
 „ *navicella*, *Rv*. Muttuwartu.
Erato angistoma, *Rv*. Tuticorin.
Zafra atrata, *Gould*. Pámban.
Columbella flavida, *Lmk*. Tuticorin, Taraitivu.
 „ *mindorensis*, *Rv*. Pámban, Kilakarai, Tuticorin,
 Karaitivu.
 „ *pusilla*, *Dunk*. Pámban.
 „ *undata*, Pámban.

Columbella versicolor, *Sow.* Pámban, Kilakarai, Tuticorin,
Karaitivu, Muttuwartu.

„ (*Anachis*) *terpsichore*, *Sow.* Pámban, Tuticorin,
Karaitivu.

Engina trifasciata, *Rv.* Pámban.

„ *zonata*, *Rv.* Pámban.

Harpa ventricosa, *Lmk.* Pámban.

Cassis areola, *Lmk.* Pámban.

„ *canaliculata*, *Lmk.* Pámban.

„ (*Bezoardica*) *glauca*, *Brug.* Pámban.

Dolium fasciatum, *Lmk.* Pámban.

„ *maculatum*, *Lmk.* Pámban.

„ *olearium*, *Linn.* Pámban.

Ficula lævigata, *Rv.* Pámban.

„ *reticulata*, *Lmk.* Pámban.

Pyrula cochlidium, *Linn.* Pámban, Cheval.

Natica ala papilionis, *Chemn.* Tuticorin.

„ *columnaris*, *Recl.* Muttuwartu.

„ *lineata*, *Lmk.* Pámban.

„ *maculosa*, *Lmk.* Pámban, Dutch Bay.

„ *maroccana*, *Chemn.* Pámban, Tuticorin.

„ *pavimentum*, *Rv.* Cheval.

„ *pulicaris*, *Phil.* Pámban, Tuticorin.

„ (*Mamilla*) *melanostoma*, *Lmk.* Tuticorin.

„ (*Neverita*) *didyma*, *Bolt.* Pámban, Muttuwartu.

„ (*Ruma*) *melanostoma*, *Lmk.* Cheval, Muttuwartu.

Sigaretus neritoideus, *Linn.* Pámban.

Naticina papilla, *Chemn.* Pámban.

Scalaria aculeata, *Sow.* Pámban.

„ *decussata*, *Pease.* Pámban.

Terebra duplicata, *Linn.* (var *Reeve*). Cheval.

„ *myuros*, *Lmk.* Pámban.

Ringicula dolearis (?) *Gould.* Tuticorin.

„ *propinquans*, *Hinds.* Pámban.

Alaba rectangularis, *Cramer.* Pámban.

Solarium lævigatum, *Lmk.* Pámban.

„ *perspectivum*, *Lmk.* Pámban.

„ (*Torinia*) *cælata*, *Hinds.* Pámban, Muttuwartu

„ (*Torinia*) *fulvum*, *Hinds.* Pámban.

Conus amadis, *Chemn.* Pámban.

„ *dispar*, *Sow.* Pámban.

„ *figulinus*, *Linn.* Pámban.

„ *geographus*, *Linn.* Tuticorin.

„ *glans*, *Hwass.* Pámban.

„ *hebraeus*, *Linn.* Pámban.

„ *litteratus*, *Linn.* Tuticorin.

„ *longurionis*, *Kien.* Tuticorin.

„ *marmoreus*, *Linn.* Pámban.

„ *peplum*, *Chemn.* Muttuwartu.

- Conus piperatus*, *Dillwyn*. Pámban.
 „ *striatus*, *Linn*. Tuticorin.
 „ *textile*, *Linn*. Tuticorin.
Strombus canarium, *Linn*. Pámban, Tuticorin.
 „ *marginatus*, *Linn*. Pámban.
 „ *urceus*, *Linn*. (var. *plicatus*). *Lmk*. Pámban.
Pterocera aurantia, *Lmk*. Pámban.
 „ *lambis*, *Linn*. Pámban.
 „ *scorpius*, *Linn*. Pámban, Tuticorin.
Cypræa arabica, *Linn*. Pámban, Tuticorin.
 „ „ „ var. *Smith*. Tuticorin.
 „ *caput serpentis*, *Linn*. Tuticorin.
 „ *carneola*, *Linn*. Tuticorin.
 „ *caurica*, *Linn*. Pámban.
 „ *errones*, *Linn*. Pámban.
 „ *hirundo*, *Gm*. Pámban.
 „ *lentiginosa*, *Gray*. Pámban.
 „ *lynx*, *Linn*. Pámban.
 „ *mauritiana*, *Linn*. Pámban, Tuticorin.
 „ *moneta*, *Linn*. Pámban.
 „ *ocellata*, *Linn*. Pámban, Tuticorin.
 „ *onyx*, *Linn*. Pámban.
 „ *talpa*, *Linn*. Tuticorin.
 „ *tigris*, *Linn*. Pámban, Tuticorin.
 „ *vitellus*, *Linn*. Tuticorin.
 „ (*Trivia*) *oryza*, *Lmk*. Karaitivu.
 „ („) *producta*, *Gask*. Tuticorin.
Ovulum (*Radius*) *arcuatum*, *Rv*. Cheval.
 „ („) *birostre*, *Linn*. Pámban.
 „ („) *formicarium*, *Sow*. Tuticorin.
 „ („) *formosus*, *Ad. & Rv*. Pámban.
 „ („) *volva*, *Linn*. Pámban.
Cancellaria costifera, *Sow*. Pámban, Tuticorin.
 „ *elegans*, *Sow*. Pámban.
 „ *serrata*, *Rv*. Dutch Bay.
Cerithium breviculum, *Sow*. Pámban.
 „ *corallinum*, *DeFr*. Tuticorin.
 „ *morus*, *Lmk*. Pámban.
 „ *purpurascens*, *Sow*. Tuticorin.
 „ *rugosum*, *Wood*. Tuticorin.
 „ *splendens*, *Sow*. Pámban.
 „ (*Aluco*) *obeliscus*, *Brug*. Pámban, Karaitivu.
 „ (*Bittium*) *lineatum*, *Dunk*. Muttuwartu.
 „ (*Tympanotomus*) *alatum*, Pámban.
 „ („) *fluviale*, *Fotiez*. Pámban.
Colina pupæformis, *A Ad*. Pámban, Kilakarai, Tuticorin.
Triforis cingulatus, *Dunk*. Tuticorin, Dutch Bay.
 „ *concinna*, *Hinds*. Pámban, Tuticorin.
 „ *violacea*, *Quoy & Gaim*. Muttuwartu.

- Potamides cingulatus, *Gm.* Tuticorin.
 „ (Pyrazus) palustris, *Linn.* Pámban.
 Melania collistrieta, *Rv.* Tuticorin.
 „ tuberculata, *Mull.* Tuticorin.
 Littorina glabrata, *Phil.* Pámban.
 „ intermedia, *Phil.* Pámban.
 „ scabra, *Linn.* Pámban, Tuticorin.
 „ undulata, *Gray.* Pámban.
 Planaxis pyramidalis, *Gm.* Pámban, Tuticorin.
 „ suturalis, *Smith.* Muttuwartu.
 Rissoina antoni, *Schum.* Pámban.
 „ media, *Schum.* Pámban, Tuticorin.
 „ planaxoides, Pámban.
 „ pusilla, *Rv.* Muttuwartu.
 „ (Phosinella) clathrata, *A. Ad.* Pámban, Tuticorin.
 Turritella attenuata, *Rv.* Pámban.
 „ duplicata, *Linn.* Pámban.
 Siliquaria encaustica, *Mösch.* Pámban, Tuticorin.
 „ lactea, *Lmk.* Pámban.
 Calyptræa neptuni, *Schum.* Pámban.
 Trochita (Galerus) extinetorium, *Sow.* Pámban, Tuticorin.
 Crepidula (Siphopatella) walchi, *Herm.* Pámban, Tuticorin,
 Dutch Bay.
 Capulus, sp. Pámban.
 Hipponyx acutus, *Quoy & Gaim.* Tuticorin.
 Vanicora granulosa, *Recl.* Pámban.
 „ Quoyiana, *A. Ad.* Pámban.
 Nerita albicilla, *Linn.* Pámban.
 „ chamæleon, *Linn.* Pámban.
 „ maura, *Brod.* Pámban.
 „ plicata, *Linn.* Pámban.
 „ Rumphii, *Recl.* Pámban.
 „ squamulata, *Le Guill.* Pámban.
 Neritina (Clithon) ualanensis, *Less.* Pámban.
 „ (Smaragdia) rangiana, *Recl.* Pámban, Tuticorin,
 Dutch Bay.
 Phasianella nivosa, *Rv.* Kilakarai, Tuticorin.
 Turbo petholatus, *Linn.* Pámban.
 „ (Senectus) margaritaceus, *Linn.* Pámban, Tuticorin.
 Calcar columellare, *Phil.* Pámban, Tuticorin, Cheval.
 Liotia cidaris, *Rv.* Pámban.
 Rotella costata, *Val.* Pámban.
 „ vestiaria, *Sow.* Tuticorin.
 Delphinula atrata, *Chemn.* Pámban.
 „ distorta, *Lmk.* Pámban, Tuticorin.
 Trochus niloticus, *Linn.* Pámban.
 „ (Clanculus) clanguloides, *Wood.* Pámban, Tuticorin.
 „ (Euchelus) atratus, *Gm.* Pámban.
 „ („) circulatus, *Anton.* Pámban, Dutch Bay.

- Trochus (Euchelus) tricarinatus, *Lmk.* Pámban.
 „ (Gibbula) variabilis, *Ad.* Tuticorin.
 „ (Monilea) Solandrii, *Phil.* Pámban.
 „ (Polydonta) costatus, *Gm.* Pámban.
 „ („) radiatus, *Gm.* Pámban.
 „ (Zizyphinus) polychroma, *Rv.* Pámban, Kilakarai,
 Tuticorin, Muttuwartu.
 „ („) tranquebaricus, *Chemn.* Pámban.
 Gena stellata, *Sow.* Muttuwartu.
 Haliotis parva, *Linn.* Muttuwartu.
 „ semistriata, *Rv.* Pámban.
 „ varia, *Linn.* Pámban.
 Fissurella clathrata, *Rv.* Pámban.
 „ octogona, *Rv.* Pámban, Tuticorin.
 „ singaporensis, *Rv.* Tuticorin.
 „ ticaonica, *Rv.* Muttuwartu.
 Emarginula obovata, *A. Ad.* Pámban, Tuticorin.
 Scutum unguis, *Linn.* Pámban, Tuticorin.
 Dentalium variabile, *Desh.* Pámban, Tuticorin.
 Scutellina asperulata, *A. Ad.* Pámban.
 „ galatea, *Lmk.* Pámban.
 Chiton. Several undetermined species.
 Solidula solidula, *Lmk.* Pámban.
 Hydatina circulata, *Martyn.* Pámban.
 Cylichna voluta, *Quoy. & Gaim.* Kilakarai.
 Bulla ampulla, *Linn.* Pámban.
 Haminea cymbalum, *Quoy & Gaim.* Pámban.
 Atys porcellana, *Gould.* Pámban.
 „ tortuosus, *A. Ad.* Kilakarai.
 Philine aperta, *Linn.* Pámban.
 Oxynoe delicatula, *Nevill.* (= *O. Sieboldii*, *Krohn ?*).
 Pámban.
 Volvatella cincta, *Nevill.* (= *V. fragilis*, *Pease ?*) Pámban.
 Lobiger viridis, *G. & H. Nevill.* Tuticorin.
 Aplysia leporina, Pámban.
 Dolabella Rumphii, *Cuv. ?* Pámban.
 Siphonaria exigua, *Sow.* Muttuwartu.

LAMELLIBRANCHIATA.

- Pholas (Martesia) striata, *Linn.* Pámban. —
 Dactylus orientalis, *Gm.* Pámban.
 Jouannetia globosa, *Quoy.* Pámban, Kilakarai.
 Guetra nucifera, *Speng.* Pámban.
 Rocellaria ovata, *Sow.* Pámban.
 Aspergillum dichotomum, *Rv.* Pámban.
 Solen adpersus, *Dunk.* Pámban, Tuticorin, Dutch Bay.
 „ corneus, *Lmk.* Tuticorin.
 Cultellus radiatus, *Linn.* Pámban, Tuticorin.

- Corbula crassa*, *Hinds*. Karaitivu.
 „ *fortisulcata*, *Smith*. Tuticorin.
 „ *modesta*, *Hinds*. Pámban, Tuticorin, Muttuwartu.
 „ *sulculosa*, *H. Ad.* Pámban, Tuticorin.
Anatina labiata, *Rv.* Pámban.
Theora fragilis, *H. Ad.* Pámban, Tuticorin.
Mactra attenuata. Karaitivu.
 „ *corbiculoides*, *Desh.* Pámban, Tuticorin.
 „ *decora*, *Desh.* Tuticorin, Dutch Bay.
 „ *lurida*, *Phil.* Dutch Bay.
Lutraria (Merope) *nicobarica*, *Gm.* Tuticorin.
Soletellina diplos, *Linn.* Pámban.
 „ *donacioides*, *Rv.* Dutch Bay.
Tellina assimilis, *Rv.* Dutch Bay.
 „ *chinensis*, *Hanl.* Tuticorin, Karaitivu.
 „ *perplexa*, *Hanl.* Pámban.
 „ *scalpellum*, *Hanl.* Pámban.
 „ *sulcata*, *Wood.* Pámban.
 „ (Arcopagia) *pristis*, *Lmk.* Pámban.
 „ (Macalia) *Bruguieri*, *Hanl.* Pámban.
 „ (Metis) *angulata*, *Chemn.* Pámban.
 „ („) *ephippium*, *Spengl.* Pámban.
Dosinia histrio, *Gm.* Pámban.
 „ *modesta*, *Rv.* Pámban.
 „ *puella*, *E. Rom.* Pámban, Dutch Bay.
 „ „ From black mud. Kilakarai, Dutch Bay.
 „ *trigona*, *Rv.* Pámban, Dutch Bay, Karaitivu.
Donax æneus, *March.* Pámban, Tuticorin.
 „ *cuneatus*, *Linn.* Pámban, Silavaturai.
 „ *Dysoni*, *Desh.* Pámban, Tuticorin.
 „ *faba*, *Chemn.* Pámban, Tuticorin.
 „ *paxillus*, *Rv.* Pámban, Tuticorin.
 „ *scortum*, *Linn.* Pámban.
Semele casta, *A. Ad.* Pámban.
 „ *crenulata*, *Sow.* Pámban.
 „ *exarata*, *Ad. & Rv.* Pámban.
 „ *striata*, *Rüpp.* Pámban, Tuticorin, Cheval, Muttuwartu.
Mesodesma (Paphia) *trigona*, *Desh.* Tuticorin.
 „ („) *glabratum*, *Lmk.* Pámban, Tuticorin.
Cytharea morphina, *Lmk.* Pámban,
Callista erycina, *Linn.* Pámban, Kilakarai.
 „ (Meretrix) *casta*, *Hanl.* Pámban.
Circe alabastrum, *Rv.* Pámban.
 „ *dispar*, *Chemn.* var. *abbreviata*, *Lmk.* Pámban.
 „ „ *Chemn.* var. *transversalis*, *Desh.* Pámban.
 „ *pæctinata*, *Linn.* Pámban. Cythoria.
 „ *personata*, *Desh.* Pámban, Muttuwartu.
 „ *scripta*, *Linn.* Pámban, Karaitivu.
 „ (Crista) *divaricata*, *Chemn.* Pámban, Tuticorin.

- Circe (Crista) gibba, *Lmk.* Pámban, Tuticorin.
 Venus arakana, *Nevill.* Pámban, Kilakarai, Karaitivu
 Dutch Bay.
 „ foliacea, *Phil.* Pámban, Cheval, Dutch Bay.
 „ Lamarcki, *Gray.* Pámban, Tuticorin.
 „ lamellaris, *Schum.* Pámban.
 „ plicata, *Linn.* Pámban.
 „ reticulata, *Linn.* Pámban.
 „ toreuma, *A. Gould.* Cheval.
 „ (Anaitis), calophylla, *Phil.* Pámban, Karaitivu.
 „ (Chione) Layardi, *Sow.* Pámban.
 „ (Cryptogramma) squamosa, *Linn.* Karaitivu.
 „ (Sunetta) effossa, *Hanl.* Pámban, Tuticorin, Cheval.
 „ („) excavata, *Hanl.* Cheval.
 „ („) scripta, *Linn.* Pámban, Tuticorin.
 „ („) truncata, *Desh.* Pámban.
 „ (Timoclea) imbricata, *Sow.* Tuticorin, Karaitivu.
 „ („) scabra, *Hanl.* Pámban, Dutch Bay.
 Tapes adspersa, *Chemn.* Pámban, Muttuwartu.
 „ litterata, *Linn.* Pámban.
 „ malabaricus, *Chemn.* Pámban, Tuticorin.
 „ rotundata, *Linn.* Pámban.
 „ textrix, *Chemn.* Pámban, Dutch Bay, Karaitivu.
 „ undulata, *Born.* Tuticorin.
 Hemitapes ceylonensis, *Sow.* Pámban.
 „ pingues, *Chemn.* Pámban, Dutch Bay.
 Venerupis carditoides, *Lmk.* Tuticorin, Dutch Bay.
 „ „ var. Muttuwartu.
 Petricola (Narania) divaricata, *Chemn.* Pámban.
 Cardium asiaticum, *Brug.* Tuticorin.
 „ latum, *Born.* Tuticorin.
 „ leucostoma, *Born.* Pámban.
 „ retusum, *Linn.* Pámban, Tuticorin.
 „ rubicundum, *Rv.* Pámban, Dutch Bay.
 „ rugosum, *Lmk.* Tuticorin.
 „ (Papyridea) rugatum, *Gron.* Pámban, Tuticorin.
 Lævicardium australe, *Sow.* Tuticorin.
 „ retusum, *Linn.* Pámban.
 Lunulicardia subretusa, *Sow.* Pámban.
 Isocardia Lamarcki, *Rv.* Muttuwartu.
 „ Moltkeana, *Chemn.* Muttuwartu.
 Chama lazarus, *Linn.* Pámban.
 Lucina pisum, *Rv.* Pámban, Tuticorin, Karaitivu.
 „ (Anodontia) edentula, *Linn.* Pámban.
 „ (Divaricella) Cumingii, *Ad. & Ang.* Tuticorin.
 „ (Lentillaria) divergens, *Phil.* Tuticorin, Muttu-
 wartu.
 Codakia Fischeriana, *Issel.* Pámban.
 Cryptodon vesicula, *Gould.* Tuticorin.

- Galeomma mauritiana*, *Desh.* Pámban.
Scintilla ambigua, *Desh.* Pámban.
 „ *candida*, *Desh.* Pámban.
 „ *Hanleyi*, *Sow.* Pámban.
Crassatella radiata, *Sow.* Pámban, Tuticorin, Cheval, Dutch Bay.
 „ *rostrata*, *Lmk.* Pámban.
Cardita bicolor, *Lmk.* Pámban, Kilakarai, Tuticorin.
 „ *variegata*, *Brug.* Pámban, Tuticorin.
 „ „ *var.* Muttuwartu.
Mytilus viridis, *Linn.* Tuticorin.
Modiola cinnamonea, *Lmk.* Pámban.
 „ *japonica*, *Dunk.* Pámban.
 „ *Metcalfei*, *Hanl.* Pámban.
 „ *perfragilis*, *Dunk.* Pámban.
 „ *Trailli*, *Rv.* Pámban.
 „ *tulipa*, *Lmk.* Pámban, Silavaturai.
Lithodomus malaccanus, *Rv.* Pámban, Cheval.
 „ *antillarum*, *Phil.* Pámban.
 „ *stramineus*, *Dunk.* Pámban, Tuticorin.
Septifer bilocularis, *Linn.* Tuticorin.
Avicula fucata, *Gould.* Tuticorin.
 „ *inquinata*, *Rv.* Tuticorin, Muttuwartu.
 „ *margaritifera*, *Linn.* Tuticorin.
 „ *radiata*, *Pease.* Tuticorin.
 „ *zebra*, *Tuticorin.* Mimics the short lateral ramuli of the hydroid (*Aglaophenia urens*) to which it is attached.
Malleus vulgaris, *Lmk.* Pámban.
Pinna, sp. Pámban.
Arca Kraussi, *Phil.* Pámban, Tuticorin, Muttuwartu, Cheval.
 „ *symmetrica*, *Rv.* Pámban, Tuticorin, Cheval.
 „ (*Acar*) *divaricata*, *Sow.* Tuticorin.
 „ (*Anadara*) *granosa*, *Linn.* Pámban, Kilakarai, Dutch Bay.
 „ (*Barbatia*) *decussata*, *Sow.* Pámban.
 „ („) *fusca*, *Brug.* Pámban, Muttuwartu.
 „ („) *lima*, *Rv.* Tuticorin, Muttuwartu.
 „ (*Parallelopipedon*) *tortuosa*, *Linn.* Pámban, Tuticorin.
 „ (*Scapharca*) *inæqualis*, *Brug.* Pámban, Tuticorin, Dutch Bay.
Pectunculus angulatus, *Lmk.* Muttuwartu.
 „ *Taylori*, *Ang.* Pámban, Tuticorin, Cheval, Dutch Bay.
Limopsis Belcheri, *Ad. & Rv.* Pámban.
Nucula mitralis, *Hind.* Dutch Bay.
Leda mauritiana, *Sow.* Pámban, Tuticorin, Karaitivu, Dutch Bay.

- Pecten Layardi*, *Rv.* Pámban.
 „ *porphyreus*, *Chemn.* Pámban.
 „ *singaporensis*, *Sow.* Muttuwartu.
 „ *speciosus*, *Rv.* Muttuwartu.
 „ *tendineus*, Tuticorin.
 „ *varius*, *Linn.* Pámban.
 „ (*Pallium*) *plica*, *Linn.* Pámban.
 „ (*Pleuronectia*) *pleuronectes*, *Linn.* Muttuwartu.
 „ (*vola*) *pyxidatus*, *Born.* Tuticorin.
Lima orientalis, *Ad. & Rv.* Pámban.
 „ *squamosa*, *Lmk.* Pámban, Cheval, Karaitivu, Muttu-
 warta.
Spondylus Layardi, *Rv.* Pámban.
Vulsella lingulata, *Lmk.* Pámban, Kilakarai.
 „ *rugosa*, *Lmk.* Pámban.
Ostrea crista galli, *Linn.* Pámban.
 „ *hyotis*, *Linn.* Tuticorin.
 „ (*Alectryonia*) *folium*, *Linn.* Pámban.

BRYOZOA.

For the identification of the following small collection of Bryozoa I am indebted to Mr. R. Kirkpatrick of the British Museum, Natural History.

a. ENCRUSTING OR GROWING ON PEARL OYSTERS.

1. *Cheilostomata*.

- Scrupocellaria*, sp.
Nellia oculata. *Busk.*
Steganoporella magnilabris, *Busk.*
Microporella (*Adeonella*) *coscinophora*. *Reuss*, var. Also found
 growing on coral-rock.
Lepralia depressa. *Busk.*
 „ *turrita*. *Smitt. ?*
Smittia reticulata. *J. Macgillivray ?* var.
 „ *rostriformis*. *Kirkpatrick ?* var.
Schizoporella cucullata. *Busk. ?*
 „ *unicornis*, *Johnst.*
Cellepora albirostris, *Smitt.*

2. *Cyclostomata*.

- Idmonea atlantica*, *Forbes*, var.
 „ n. sp. (?). Also found in crevices of coral.

b. OTHER BRYOZOA.

- Flustra foliacea*, *Linn.* Foliateous, and encrusting phanerogams on Ceylon pearl-banks.
Biflustra (*Membranipora*), *savartii*. *Audouin.* Massive, and encrusting *Gorgoniae*. Rámésvaram island.
Lepralia gigas, *Hinks.* Eschara form. Rámésvaram Island.
Cribrilina radiata, *Moll.* var.
 „ *innominata.* *Couch.*

TUNICATA.

Ecteinascidia thurstoni, *Herdman.*

A single specimen of this social ascidian, composed of a large number of ascidiozooids united together by a delicate branched stolon, which was fixed to the stem of a hydroid zoophyte, was brought up by my divers during one of my visits to Rámésvaram island, and kept alive for some days in the aquarium. The specimen was sent to Professor Herdman, by whom it has been described ³² as a new species closely allied to *Ecteinascidia turbinata*, Herdm. from Bermuda.

PISCES.

The following list comprises those species of fishes which I have either recorded or preserved during my visits to Tuticorin or Pámban on the Madras coast of the gulf of Manaar, which latter place I made my head-quarters while exploring the coral reefs which fringe the shores of Rámésvaram and the neighbouring islands. These visits have always been made during the months of July and August, so that my examination of the fish fauna has been confined to a very limited period of the year, and it will doubtless be found, on more extended research to, vary according to the season or monsoon.

The most characteristic feature of the fauna, as contrasted with that of other parts of the coast of the Madras Presidency, is the prevalence of the so-called 'coral fishes' (*Chaetodon*, *Heniochus*, *Pseudoscarus*, &c.), for the most brightly coloured fishes which abound over the reefs, and feed either on the small delicate marine invertebrates which swarm on the living corals, or, if their teeth are adapted

³² *Trans. Biol. Soc. Liverpool*, vol. v, 1891.

for the purpose, on the soft parts of mollusc, which they extract by gnawing or boring holes into the hard substance of the shell. As stated by Haeckel, ³³ an explanation of the bright colouring of the fishes is found in the Darwinian principle, that the less the predominant colouring of any creature varies from that of its surroundings, the less likely it is to be seen by its foes, the more easily it can steal upon its prey, and the more it is fitted for the struggle for existence.

Conspicuous by their abundance were several species belonging to the family Sclerodermi, including *Balistes* (file or trigger fish), whose jaws are armed with sharp teeth, and which are said to be injurious to the pearl fishery by preying on the pearl oyster. Present, too, in great numbers, were several species of the family gymnodontes, *Tetrodons* (globe or frog fishes), including the beautifully marked little *T. margaritatus*, and *Diodons*, which have a bad reputation among the natives as being very poisonous.

Many of the brightly coloured fishes were preserved by the process, devised by Mr. A. Haly, Director of the Colombo Museum, which consists in cutting the fish in half by a medium longitudinal section, clearing away the bulk of the flesh, immersing for some days in a gum, glycerine, arsenic mixture ³⁴ and finally mounting in pure glycerine. Specimens preserved in this way in 1888 still (1893) retain many of their brilliant hues, and of some of them paintings, accurate as regards colour, could still be made.

ELASMOBRANCHII.

(Sharks and Rays.)

CARCHARIIDÆ.

Carcharias. The young of several species commonly met with in the fish markets.

Zygæna malleus, *Shaw*. Pámban, Tuticorin.

SCYLLIIDÆ.

Stegostoma tigrinum, *Gmel.* Tuticorin.

Chiloscyllium indicum, *Gmel.* Tuticorin.

³³ *A Visit to Ceylon*, Eng. Trans., 1883.

³⁴ Gum, 1 oz., glycerine, 1 oz., arsenious acid, $1\frac{1}{2}$ gr., water, 1 oz.

PRISTIDÆ (SAW FISHES).

Pristis cuspidatus, *Lath.* A specimen 18 feet in length brought on shore at Tuticorin in 1887.

RHINOBATIDÆ.

Rhinobatus granulatus, *Cuv.* Tuticorin.

TORPEDINIDÆ.

Narcine timlei, (*Bl. Schn.*). Pámban.

TRYGONIDÆ.

Trygon sephen, (*Försk.*) Tuticorin.

„ *uarnak*, (*Försk.*) Pámban, Tuticorin.

Pteroplatea micrura, (*Bl. Schn.*). A single female with twins *in utero* obtained at Pámban.

MYLIOBATIDÆ.

Myliobatis nieuhofii, (*Bl. Schn.*). Pámban.

TELEOSTEI (BONY FISHES).

MURÆNIDÆ (EELS).

Muræna tessellata, *Richardson.* Pámban, Tuticorin.

„ *undulata*, (*Lacép.*) Tuticorin.

SILURIDÆ.

Arius thalassinus, (*Rüpp.*) Pámban, Tuticorin.

CLUPEIDÆ (HERRINGS).

Pellona leschenaultii, *Cuv. & Val.* Pámban.

SCOPELIDÆ.

Saurida tumbil, (*Bloch.*) Pámban.

SCOMBRESOCIDÆ.

Hemiramphus xanthopterus, (*Cuv. & Val.*) Pámban.

PERCIDÆ (PERCHES).

- Lates calcarifer*, (*Bloch.*). Pámban, Tuticorin. The "*cock-up.*"
Largely eaten by Europeans in
Calcutta under the name of *begti.*
- Serranus boenack*, (*Bloch.*). Tuticorin.
 „ *diacanthus*, *Cuv. & Val.* Pámban.
 „ *hexagonatus*, (*Bl. Schn.*). Pámban.
 „ *hoevenii*, *Bleeker.* Pámban.
 „ *fasciatus*, (*Försk.*). Pámban.
 „ *salmoides*, (*Lacép.*). Tuticorin.
- Lutjanus annularis*, (*Cuv. & Val.*). Pámban.
 „ *decussatus*, (*Cuv. & Val.*). Pámban.
 „ *fulviflamma*, (*Försk.*). Pámban.
 „ *rivulatus*, (*Cuv. & Val.*). Pámban, Tuticorin.
 „ *roseus*, *Day.* Pámban.
- Therapon quadrilineatus*, (*Bloch.*). Pámban.
 „ *theraps*, *Cuv. & Val.* Pámban.
- Pristipoma hasta*, (*Bloch.*). Pámban.
- Diagramma crassispinum*, *Rüpp.* Pámban, Tuticorin.
 „ *cuvieri*, (*Bennett.*). Pámban.
 „ *griseum*, *Cuv. & Val.* Pámban, Tuticorin.
- Scolopsis vosmeri*, (*Bloch.*). Pámban, Tuticorin.
- Apogon auritus*, *Cuv. & Val.* Tuticorin.
 „ *calosoma*, *Bleeker.* Pámban.
 „ *thurstoni*, *Day.* Pámban.
- Chilodipterus quinquelineatus*, *Cuv. & Val.* Pámban.
- Gerres oyena* (*Försk.*). Pámban.

SQUAMIPINNES.

- Chætodon auriga*, *Försk.* Pámban.
 „ *collaris*, *Bloch.* Pámban.
 „ *vagabundus*, *Linn.* Pámban.
- Heniochus macrolepidotus*, *Linn.* Pámban.
- Drepane punctata*, (*Gmel.*) Pámban.
- Scatophagus argus*, (*Bloch.*) Pámban, Tuticorin.

MULLIDÆ (RED MULLET).

- Upeneoides tragula*, (*Richardson.*) Pámban, Tuticorin.
- Upeneus indicus*, (*Shaw.*) Pámban.

SPARIDÆ (BREAMS).

- Lethrinus karwa*, *Cuv. & Val.* Tuticorin.
 „ *nebulosus*, (*Försk.*). Pámban.
- Chrysophrys berda*, (*Försk.*) Tuticorin.
- Pimelepterus cinerascens*, (*Försk.*) Pámban, Tuticorin.

SCORPÆNIDÆ.

Pterois miles, (*Bennett*). Pámban.

TEUTHIDIDÆ.

Teuthis marmorata, (*Q. & G.*). Tuticorin.
 „ oramin, *Günth.* Pámban, Tuticorin.

BERYCIDÆ.

Holocentrum rubrum, (*Försk.*). Pámban, Tuticorin.

KURTIDÆ.

Pempheris malabarica, *Cuv. & Val.* Tuticorin.

SCIÆNIDÆ.

Sciæna maculata, (*Bl. Schn.*). Tuticorin.

ACANTHURIDÆ (SURGEONS).

Acanthurus gahm, *Cuv. & Val.* Pámban, Tuticorin.
 „ triostegus, (*Linn.*). Pámban.
 „ velifer, (*Bloch.*). Pámban.

CARANGIDÆ (HORSE MACKERELS).

Caranx gallus, (*Linn.*). Pámban, Tuticorin.
 „ hippos, (*Linn.*). Tuticorin.
 „ ire, (*Cuv. & Val.*). Pámban.
 „ rottleri, (*Bloch.*). Tuticorin.
 „ sansun, (*Försk.*). Tuticorin.
 „ speciosus, (*Gmel.*). Pámban.
 Platax teira, (*Försk.*). Pámban.
 Lactarius delicatulus, *Cuv. & Val.* Pámban.
 Equula edentula, (*Bloch.*). Pámban.

SCOMBRIDÆ (MACKERELS).

Echeneis remora, *Linn.* Tuticorin. Crushed shells of the pearl oyster, and pearls have been found in the stomach.
 „ naucrates, *Linn.* Tuticorin.

TRACHINIDÆ.

Sillago sihama, (*Försk.*). Tuticorin. Called “whiting” by Europeans.

GOBIIDÆ (GOBIES).

- Gobius bynoensis, *Rich.* Tuticorin.
 „ citrinus, (*Rüpp.*) Tuticorin.
 Periophthalmus koelkreuteri, (*Pall.*) Pámban.
 Boleophthalmus boddaerti, (*Pall.*) Pámban.

BLENNIIDÆ.

- Salarias marmoratus, (*Benn.*) Tuticorin.

MUGILIDÆ (GREY MULLET).

- Mugil pœcilus, *Day.* Tuticorin.
 „ cunnesius, *Cuv. & Val.* Tuticorin.
 „ speigleri, *Bleeker.* Pámban.

CENTRISCIDÆ.

- Amphisile scutata, (*Linn.*) Pámban.

GLYPHIDODONTIDÆ.

- Glyphidodon antjerius, *Cuv. & Val.* Tuticorin.
 „ cælestinus, *Cuv. & Val.* Pámban.
 „ notatus, *Day.* Pámban.
 „ sordidus, (*Forsk.*) Pámban.
 Tetradrachmum aruanum, (*Linn.*) Tuticorin.
 Amphiprion sebæ, *Bleeker.* Pámban.

LABRIDÆ (WRASSES).

- Chilinus chlorurus, (*Bloch.*) Pámban.
 PlatyGLOSSUS dussumieri, (*Cuv. & Val.*) Pámban.
 PseudoscARUS chrysopoma, (*Bleeker.*) Pámban, Tuticorin.
 „ rivulatus, (*Cuv. & Val.*) Pámban.

PLEURONECTIDÆ (FLAT FISHES).

- Plagusia marmorata, *Bleeker.* Pámban.
 Cynoglossus macrolepidotus, (*Bleeker.*) Pámban.

SYNGNATHIDÆ (PIPE FISHES).

- Syngnathus serratus, *Temm. & Schleg.* Pámban, Tuticorin.

SCLERODERMI.

- Balistes mitis, *Ben.* Pámban. File Fish.
 „ vetula, *Linn.* Tuticorin. File Fish.

- Triacanthus strigilifer, *Cantor*. Pámban.
 Ostracion cornutus, *Linn.* Pámban. Coffe Fish.
 „ nasus, *Bloch*. Pámban. Coffe Fish.
 „ turritus, *Försk.* Pámban. Coffe Fish.

GYMNODONTES.

- Tetrodon hispidus, *Bloch*. Pámban.
 „ margaritatus, *Rüpp.* Pámban.
 „ immaculatus, *Bl. Schn.* Pámban.
 Diodon hystrix, *Linn.* Pámban.
 „ maculatus, *Günth.* Pámban.

LEPTOCEPHALUS, sp.

As regards the curious pellucid leptocephali, of which I have obtained a few specimens in the gulf of Manaar, and a large number from the meshes of the fishermen's nets at Gopalpur, where they are known as sea-leeches, Dr. Günther says: ³⁵

“We must come to the conclusion that these leptocephatids are the offsprings of various kinds marine fishes, representing, not a normal stage of development (larvæ), but an arrest of development at a very early period of their life; they continue to grow to a certain size without corresponding development of their internal organs, and perish without having obtained the characters of the perfect animal.”

³⁵ *Introduction to Study of Fishes*, 1880, pp. 179-182.

MADRAS GOVERNMENT MUSEUM.

Bulletin No. 4.

ANTHROPOLOGY

OF THE

TODAS AND KOTAS OF THE NILGIRI HILLS;

AND OF THE

BRÁHMANS, KAMMÁLANS, PALLIS, AND
PARIAHS OF MADRAS CITY.

BY

EDGAR THURSTON, C.M.Z S., ETC.,

Superintendent, Madras Government Museum.

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Madras Government Museum Bulletins.

No. 1.—PEARL AND CHANK FISHERIES OF THE GULF OF MANAAR.

No. 2.—NOTE ON TOURS ALONG THE MALABAR COAST.

No. 3.—RÁMÉSIVARAM ISLAND AND FAUNA OF THE GULF OF MANAAR.

No. 5.—ANTHROPOLOGY OF THE BADAGAS AND IRULAS OF THE NILGIRIS AND, PANIYANS OF THE WYNÁD (in the Press).

Nature.—"A series of Bulletins of the Madras Government Museum has been commenced by the Superintendent, Mr. Edgar Thurston, and Parts I and II, which have reached this country, contain much useful information upon the fisheries and marine zoology of the Presidency. Part I contains a revised account of the 'Notes on the Pearl and Chank Fisheries of the Gulf of Mannar'; and its subject-matter is already known in great part to British students of 'applied zoology.' Part II entitled 'Note on Tours along the Malabar Coast,' records a number of interesting observations in marine zoology made on the West Coast of Madras. It is interesting to note that even there the natives have their fishery question."

Calcutta Review.—Bulletin No. 1, Pearl and Chank Fisheries. "Wonderful is the quantity of information Mr. Thurston has deftly compressed within the 58 pages of what he modestly calls a Bulletin. Science, archæology, political economy, folklore, Sir Edwin Arnold's poetry, are all laid under contribution, and yet in every page the author's shrewd personality asserts itself. He makes a dull topic bright, and contrives to enliven the driest of details."

Indian Journal of Education.—In Bulletin No. 1 Mr. Thurston gives, in a very pleasant and readable form, an account of his visits to the pearl and chank fishing grounds of the Madras and Ceylon Governments. Those who take an interest in the commercial industries of India will find much valuable information. The naturalist too will discover much that claims his attention in these pages, for in a graphic and interesting way the writer has contrived to throw in a large number of facts relative to the fauna of the Gulf of Manaar.

"No one doubts that the seas, which lave our Indian Coasts, are abundantly stocked with edible fish, but the problem of making these vast resources available for the food supply of the half-fed masses of this country, has never yet been satisfactorily solved. We recommend Bulletin No. 2 to the attention of every thoughtful reader."

Nature.—In the third *Bulletin* of the Madras Government Museum appears a revised edition of Mr. Edgar Thurston's "Rámésivaram Island and the Fauna of the Gulf of Manaar." The situation of Rámésivaram, the reef which, under the name of Adam's Bridge, almost connects Ceylon with the mainland of India, renders an account of its flora and fauna particularly interesting; and the present brochure, which is illustrated with several charts and photographs of the coast, furnishes a useful supplement to Haeckel's graphic pages upon the island of Ceylon. The observations recorded are admitted to be far from exhaustive of the biological features of the Gulf of Manaar, but they are more than sufficient to indicate the existence of a fauna well worthy of further examination.

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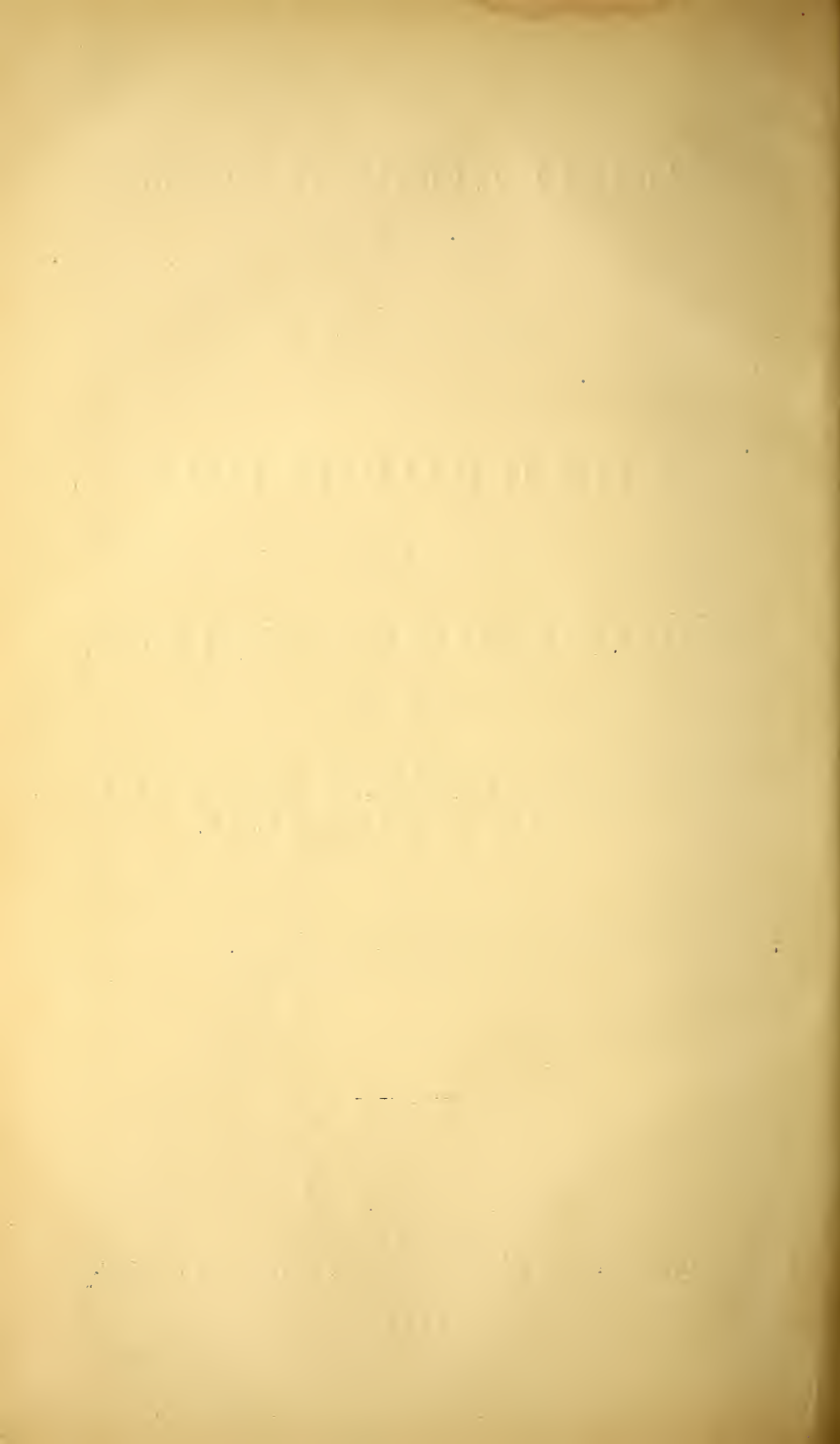
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A TODA BEAUTY

THE TODAS OF THE NILGIRIS.

A CURIOUS people are the Todas or Tudas, to whom the most sacred objects on this earth are a holy dairy-man (pālāl) and a large-horned race of semi-domesticated buffaloes, on whose milk and the products thereof (butter and ney ¹) they still depend largely, though to a less extent than in bygone days, before the existence of the Ootacamund bazār, for subsistence.

Their origin is, in the absence of any except very vague tradition connecting them with Rāma or Rāvana, and of written language, veiled in obscurity, but they take it on trust, without displaying any interest in the matter, that they are the original inhabitants of the Nilgiris, on which they have dwelt from time immemorial. "So," they say, "our grandfathers told us. How can we know otherwise?"

Being myself no philologist, I must rest content with merely recording, without criticism, the different views which have been pronounced as to the origin of the Toda language. According to Dr. Pope, it seems to have been originally old Kanarese, and not a distinct dialect. Dr. Caldwell held, on the other hand, to the view that, of all the Dravidian idioms, Tamil is that to which the Toda language is most nearly allied; and the German missionary Metz found at least eighty out of a hundred words commonly made use of by a Toda to be indentical with, or derived from, words used by their Dravidian neighbours, and thought that the language is most nearly connected with old Kanarese.

According to Dr. Oppert, the latest philological writer on the races of Southern India,² the Todas are of Turanian or Scythian descent, and there is no doubt but that they belong to the Gaudian branch of the Gauda-Dravidian group, whose settlements got flooded out by successive waves of the Aryan invasion. If this theory be true, the Todas were originally mountaineers, even if, as Dr. Oppert says, they ascended from the plains to the Nilgiri Hills. In support of the origin of their name from Koda or Kuda, signifying

¹ Ney=ghī or clarified butter.

² The Original Inhabitants of India, 1893.

a mountaineer, he records that, when inquiring into their name, he was informed by various natives, and even by some Todas, that the Todavar are also called Kodavar. This statement is, however, not borne out by the replies to my repeated inquiries in search of confirmation thereof. Todavar the Todas admit, but they will not hear of their being called Kodavar, despite the fact that there is a Toda mand at Kodanād on the eastern side of the Nilgiris.

According to Colonel Marshall, whose 'Phrenologist among the Todas' (1873) should be read by any who are interested in the tribe, "there is much of the 'blameless Ethiopian' about them: something of the Jew and of the Chaldæan in their appearance."

An attempt has been made to connect the Todas with the lost tribes, and, amid a crowd of Todas assembled together to celebrate a funeral rite, there is no difficulty in picking out many individuals, whose features would find for them a ready place as actors on the Ober Amergau stage, either in leading or subordinate parts.

Clothed and without arms, the Todas for the most part lead a simple pastoral life, comparatively little influenced by the presence of Europeans in their midst. Female infanticide, which was formerly practised to a wide extent, has, however, entirely ceased under British rule. There can, I think, be no doubt that Toda infanticide must be attributed to a desire to keep down the population, and not, as has been suggested, to a desire felt by the women to retain their good looks, which rapidly disappear, whether the babies are killed or no. "I don't know," said an elderly Toda to Colonel Marshall, "whether it was wrong or not to kill them, but we were very poor, and could not support our children. Now every one has a mantle (putkūli), but formerly there was only one for the whole family, and he who had to go out took the mantle, the rest remaining at home naked all but the loin cloth (kuvn)." Polyandry is, in consequence of the larger number of females who now grow up and become available for matrimonial purposes, on the decline, and resorted to only by the poorer class of Todas, who have not the means to support a separate married establishment. Of polyandry the Todas are at heart ashamed, and strenuously deny its existence until hard pressed. The Ootacamund Todas assured me that in their mands no cases of polyandry existed, but that it was practised by the 'jungle Todas' at Paikāra. But, during my stay at Paikāra, I was quite as strongly assured that no woman of the neighbouring mands



TODA MAN

had more than one husband, though polyandry prevailed at Ootacamund.

In the system of polyandry as practised by the Todas, if one of several brothers is married to a woman, the other brothers may, as my interpreter expressed it, 'enjoy privileges'; or, if a man's wife has one or more younger sisters, they may become wives of their sister's husband or husbands—an arrangement which complicates relationship. In lieu of a no-admission card or 'not-at-home' box, a walking stick and mantle (putkūli) are placed outside the door of the hut as an indication that one of the men is with the woman, and entrance into the hut is forbidden.

During the last quarter of a century the number of Todas, both male and female, has increased to a slight extent, as shown by the following tabular statement based on the census figures of 1871, 1881, and 1891 :—

Year.			Males.	Females.	Total.
1871	...	...	405	288	693
1881	...	...	380	293	673
1891	...	...	424	312	736
Increase			19	24	43

Writing in 1868, Dr. Shortt in his 'Account of the tribes of the Nilgiris,' makes a sweeping assertion that "most of their women have been debauched by Europeans, who, it is sad to observe, have introduced diseases, to which these innocent tribes were at one time perfect strangers, and which, as they have no means of curing, are slowly, but no less surely sapping their once hardy and vigorous constitutions. The effects of intemperance and disease (syphilis) combined are becoming more and more apparent in the shaken and decrepit appearance, which at the present day these tribes generally present." Fact it undoubtedly is, and proved both by hospital and naked-eye evidence, that syphilis has been introduced among the Todas, as among the Andamanese, by contact with more civilised races. Fact it also undoubtedly is, notwithstanding Colonel Marshall's phrenological belief that the necessity for stimulants is a property of the brachycephalic head, that the dolichocephalic Toda displays a marked partiality for gin, port, bottled beer

and arrack, and will willingly drink neat brandy in a mug ; and the silver coins given, with cheroots, as a bribe to induce subjects to come and have their measurements recorded at my improvised laboratory, were expended entirely on drink in the bazár. But I have never seen a Toda, as I have repeatedly seen Kotas and Badagas, staggering homeward from the drink shops in the bazár in a disgusting state of brawling intoxication, or, in fact, much the worse for drink. Nor would any one who has studied them regard the Todas otherwise than as a hardy race, of fine physique, and, in the case of the women, modestly behaved (with an occasional exception of solicitation) in the presence of Europeans, despite the oft-repeated statement that "the women show an absence of any sense of decency or indecency in exposing their naked persons in the presence of strangers."

Morality, it must be confessed, is reduced to a very low ebb previous to marriage—a civil contract which is regarded as binding, and acts, in some measure, as a check to irregular intercourse. And, it must also be confessed, the Toda has not a strict regard for truth, when any advantage is to be derived from telling a falsehood. As an example of mild Toda mendacity the following incident may be quoted. Instructions had been issued for a girl aged ten to be brought to me to be measured and photographed. On the following day a damsel was accordingly produced, who was stated to be ten years old, and not to have reached puberty. She was well developed, with the measurements of a young adult ; possessed a well marked moustache ; and was tattooed, as if she was a married woman, on the chest, hand, legs and feet. It was explained to me that the girl and a friend had tattooed each other as a joke. I attributed the story of her age and the origin of the tattoo marks to mendacity with a view to the receipt of the customary baksheesh ; and it subsequently turned out that the girl was at least eighteen years old, had been married some years previously and divorced for immorality, and was about to marry a second husband undaunted by her previous life history. In the case just cited the age was wilfully misrepresented ; but, as a matter of fact, the Todas have very little idea of age after they are grown up. A little cross questioning would at times bring the subject's age down, *e.g.*, from seventy to fifty, recalling to mind the story of the Native who remarked : "This year my father is sixty-eight. Next year he will be one hundred and eight."



TODA WOMAN

In the course of my wanderings I met with more than one man who had served, or was still serving, Government in the modest capacity of a forest guard; and I have heard of others who have been employed, not with conspicuous success, on planter's estates. In connection with the objection of the Todas to work, it is recorded that when, on one occasion, a mistake about the ownership of some buffaloes committed an old Toda to jail, it was found impossible to induce him to work with the convicts, and the authorities, unwilling to resort to hard measures, were compelled to save appearances by making him an overseer.

At the present day the Nilgiri C.M.S. Tamil Mission has extended its sphere of work to the Todas, and I cannot resist the temptation to narrate the Toda version of the story of Dives and Lazarus, with its moral, as given, I believe, to a missionary lady on the occasion of an examination. The English say that once upon a time a rich man and a poor man died. At the funeral of the rich man there was a great tamášha, and many buffaloes were sacrificed. But for the funeral of the poor man neither music nor buffaloes were provided. The English believe that in the next world the poor man was as well off as the rich man, so that, when any one dies, it is of no use spending money on the funeral ceremonies.

Two schools have been established, one at Ootacamund, the other near Paikāra. It is said that, in their yearly migration to distant mands for change of pasture for their herds, some of the Todas leave their children behind at the mands near the schools, with some one to take care of them, in order that their lessons may not be interrupted. No Toda, I was informed, has as yet been baptised.

A Toda 'conductor,' who receives a small monthly salary, and capitation allowance for every child who attends school regularly, showed us the way to the Paikāra school, where eighteen children (sixteen boys and two girls), varying in age from seven to sixteen, and some clad in ill-fitting jackets instead of the picturesque putkūli, were reading elementary Tamil and English, and doing simple arithmetic. One boy, a bright and intelligent lad, aged twelve, was working for the 'third standard,' and read English very fairly, but with artificial Hindu intonation instead of the natural musical Toda voice. I could not help wondering whether this lad will be content, as he grows up, to live the simple life of a Toda herdsman, or will enter into the lists in the struggle for a small-paid appointment under

Government. The Toda is even now, as I have experienced, capable of submitting petitions, written in the bazár, 'begging your honour,' etc.; and it is to be feared, from an ethnographic standpoint, that the spread of education among them will tend to obliterate that spirit of independence and simplicity of character which have hitherto distinguished the Todas favourably from the other inhabitants of Southern India. A quarter of a century ago the Todas are said to have had "just so much knowledge of the speech of their vassals as is demanded by the most ordinary requirements";³ whereas, at the present day, a few write, and many converse fluently in Tamil. One man I came across, who, with several other Todas, was selected on account of fine physique for exhibition at Barnum's show in Europe, America, and Australia some years ago, and still retained a smattering of English, talking fondly of 'Shumbu' (the elephant Jumbo). For some time after his return to his hill abode, a tall white hat (cylinder-hut) was the admiration of his fellow tribesmen. To this man finger prints came as no novelty, as his impressions were recorded both in England and America.

A self-possessed and cheery person is the Toda, and

Characteristics.

fully capable of appreciating a joke. The appearance of a European (who is greeted as swāmi) in a mand is a signal for a general cry among the inhabitants, male and female, for inām (alms), not so much because they are professional mendicants, as because experience has taught them that visitors generally disgorge small sums, and, like the Father of the Marshalsea, they make capital out of human weakness. As a rule, they have no objection to Europeans entering into their huts, but on one occasion we were politely requested to take off our boots before crawling in on our stomachs, so as not to desecrate "the deep recesses of their odorous dwelling."

The friendly disposition of the Todas towards Europeans is well brought out by the following note, with which a former forest-settlement officer of the Nilgiris has been good enough to supply me. "Bickapathi mand, or, as Tommy Atkins from Wellington dubs it, Pick-pack mand, is one of the most picturesque. It is situated on the top of a grand saddle, and furnishes a magnificent view of the Mysore ditch and the grand teak forests beyond. I had frequent occasion to go there, and soon got on friendly

³ W. Ross King—*The Aboriginal Tribes of the Nilgiri Hills*,

terms with the Todas, whose ladies greatly appreciated the bazár-made sweetmeats of Ootacamund, and whose men—Toda-like—were always ready to accept the seeds of garden vegetables given to them by the forest officer, so long as a Badaga did all the digging, weeding and bedding, at our expense. One bright little girl, aged about eight, used to sing to us in the evening a Tamil song, which she had picked up from a C.M.S. Missionary, the refrain of which, 'Thēvan nallavan' (God is good), chanted in her quaint crooning little voice, still runs in my head. Meantime her brother, a good-looking picturesque lad aged ten, would wait expectantly by, watching with wistful eye until the expected piece of chocolate, fig, biscuit, or other delicacy, was forthcoming.

"One night, while we were encamped hard by, a tiger, or possibly a pair of them, stampeded the buffaloes out of the kraal close to the mand, and killed no less than six of them, as they blindly fled for a couple of miles over almost impassable country. It was my good fortune a few days later to come across, stalk in the open, and shoot this tiger. Nor was this all, for, on the following day, I shot close to the mand a sāmbar stag (*Cervus unicolor*). In a space of twenty-four hours I had thus ridded the mand of their dreaded enemy the tiger, and got for its inhabitants a surfeit of the only flesh that Todas are allowed to eat. This was too great an occasion to be passed over in silence, or to be treated with ordinary formalities. Something special was called for, and the Todas, to a man and woman, rose to the occasion. A new and original ode, in which I, and not the evergreen Rāman, was the hero, was improvised. The Todas from the neighbouring mands were hastily summoned; a dress rehearsal was held at mid-day; and in the evening a friend and I were treated to the serenade. I wish I had a copy of the ode. Its fine dithyrambic periods reminded us of Pindar in his loftiest moments. The whole available musical talent of the mand was requisitioned, and, as we sat beneath the clear canopy of a star-decked sky, we felt the performance was one worth going miles to see and hear."

The typical Toda man is above medium height, well proportioned and stalwart, with straight nose, regular features, and perfect teeth. In some instances the expression is of a conspicuously Jewish type, but, as Colonel Ross King points out ⁴ "the general contour of the head and cast of

⁴ *Op. cit.*

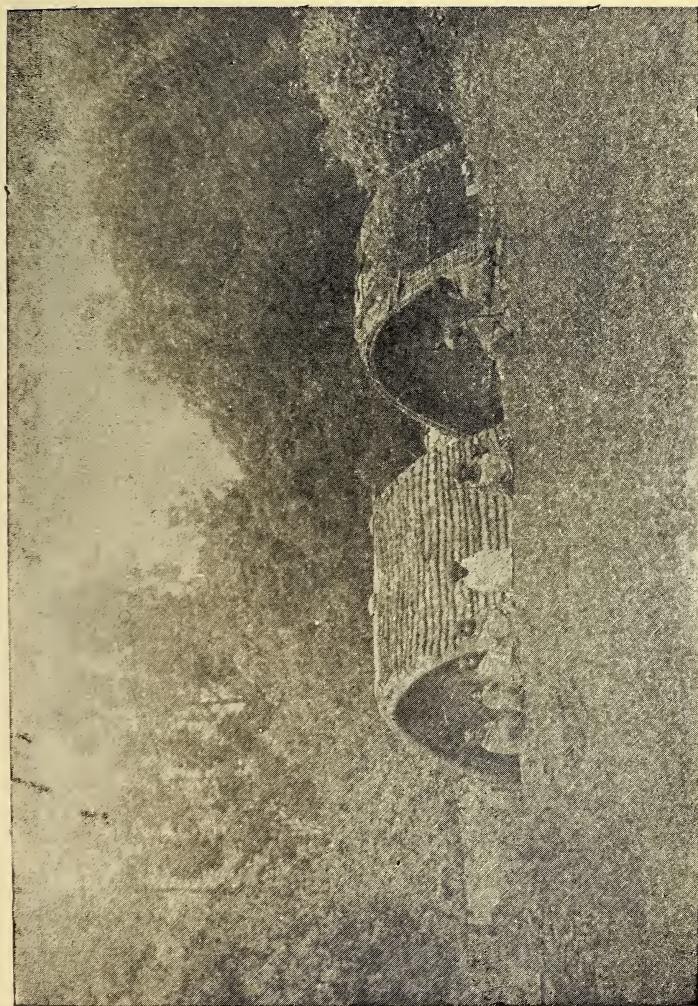
countenance are rather such as we are accustomed to associate with the ancient Roman;" and their outer garment (putkūli) of thick cotton cloth with red and blue stripes woven into it, which reaches from the shoulders to the knees, hanging in graceful folds, with one end flung over the left shoulder, is commonly (and wrongly) compared to the Roman toga.

The principal characteristic, which at once distinguishes the Todas from the other tribes of the Nilgiris, is the development of the pilous (hairy) system. This characteristic, as well as the projecting superciliary arches, and dolichocephalic skull, the Toda man possesses in common with the Australians and the Ainus, but it sinks into insignificance before the remarkable hairy development represented in Mr. Savage Landor's illustration of his lunatic Ainu friend. Occasionally, as my notes record, the hair is feebly developed on the chest; but only in one case—that of a man aged fifty—out of the large number which I have examined, have I observed a marked arrest of development of the hairy system (pl. xviii). The hair of the head was in this case short, and not bushy; beard, whiskers and moustache were represented by light down, and gave the man the appearance of a professional actor. There was an absence of hair on the chest and abdomen; a few stray hairs in the armpits, no hair on the back and upper arms; and only feebly-developed hair on the extensor surface of the fore-arms and lower extremities.

The odour of the person of the Todas, caused, I imagine, by the rancid butter which they apply to their cloths as a preservative agent, is quite characteristic, and furnishes a differential character. The missionary Huc declared that he could recognise the Negro, Tartar, Thibetan, Hindu and Chinese by their effluvium; and, with a view to testing his sense of smell, long after our return from the Nilgiris, I blindfolded a friend, who had accompanied me on my Toda campaign, and presented before his nose a cloth, which he at once recognised as having something to do with the Todas by its strong and characteristic odour.

As a type of a Toda man in many points, though considerably below the average height, the following case may be cited:—

1. Male, aged 40. Owns twenty buffaloes; makes ney from the milk, and sells it in the Ootacamund bazár. With the proceeds purchases rice, salt, chillies, tamarinds, saffron,



TODA MAND.

potatoes, brinjals (the fruit of *Solanum melongena*), etc. Does not as a rule eat meat, but says that he would have no objection to eating the flesh of sambar (*Cervus unicolor*). Drinks arrack, gin, bottled beer, etc.

Height 159.2 cm.

Weight 98 lbs.

Skin dirty copper brown, much darker than that of the surrounding females.

Hair black, with stray grey hairs on head, face, chest and shoulders. Beard luxuriant. Hair of head parted in middle, and hanging in curls over forehead and back of neck. Hair thickly developed on chest and abdomen, with median strip of dense hairs on the latter. Hair thick over upper and lower ends of scapulæ (shoulder blades), thinner over rest of back; well developed on extensor surface of upper arms, and both surfaces of fore-arms; very thick on extensor surfaces of the latter. Hair abundant on both surfaces of legs; thickest on outer side of thighs and round patella (knee-cap). Dense beard-like mass of hair beneath gluteal region (buttocks).

Face much corrugated. Length from vertex to chin 20.1 cm. Bizygomatic breadth 12.6 cm. Bigoniac breadth 9.3 cm. Glabella indistinct. Superciliary ridges very prominent. Eyebrows united across middle line by thick tuft of hairs. Cheek-bones not prominent. Lips medium, somewhat everted, not prognathous. Facial angle (of Cuvier) 67°. Teeth pearly white, entire, large, and regular.

Eyes horizontal. Iris light-brown. Incipient arcus senilis.⁵ Conjunctivæ injected (this is unusual). Upper eyelid not thick; does not partially cover caruncle.⁶

Nose of semitic type. Bridge well defined. Height 5.3 cm.; breadth 3.5 cm. Nostrils wide; 2 cm. in length.

Ears not outstanding. Points well developed. Lobules detached, and pierced. Ear 5.8 cm. in length.

Cephalic length 20 cm. (the longest measurement recorded);⁷ breadth 14.6 cm.

Chest 81 cm. in circumference.

Shoulders 38.5 cm.

Hand, length 18 cm.; breadth 8.3 cm. Length of middle finger 11.7 cm. Nails of left hand kept very

⁵ Arcus senilis is a ring of fatty degeneration in the peripheral zone of the cornea.

⁶ In a very few cases the upper eyelid was noticed partially covering the caruncle.

long for combing and scratching hair. Fingers broad; nails square. Two brass rings on right little finger; two steel rings on left ring finger, and one steel ring on left little finger.

(*Note*.—The Toda men do not indulge in jewelry to the same extent as the Kotas.)

Foot, length 25·3 cm.; max : breadth 9·3 cm.

The average height of the Toda man, according to my measurements, is 169·6 cm., but one of the men who were selected for exhibition at Barnum's show, was 179 cm. high, and at a funeral ceremony I picked out a man towering above every one else, whose measurements were as follows :—

2. Man, aged 25. Pigeon breasted.

Height 185 cm. Record by 6 cm.

Chest 84·5 cm.

Shoulders 40·5 cm.

Grande envergure (span of arms), 194 cm. Record by 5·2 cm.

Cubit, 53·2 cm. Record by 2·9 cm.

Hand, length 20 cm.; breadth 8·8 cm.

Middle finger, length 12·9 cm. Record by ·2 cm.

Hips, 29 cm.

Foot, length 27·4 cm.; max : breadth 9·5 cm.

3. The strongest man whom I came across was an elderly monegar (head-man) of venerable appearance, wearing a turban in virtue of his position. His teeth were entire, and sound, indicating the enjoyment of good digestion. The upper eyelid partially covered the caruncle. There was a preponderance of white hair on the head and face; snow white hair on the chest; and black hair on the back, arms, abdomen, and legs. His measurements, as compared with the Toda average, are herewith recorded :—

			Monegar aged 50-55.	Toda average.
Dynamometer	..	..	112 lbs.	79 lbs.
Height	..	..	175 cm.	169·6 cm.
Span of arms	..	..	179 "	175 "
Shoulders	..	..	39·5 "	39·3 "
Chest	..	..	93 "	83 "
Biceps (circumference)	..	..	32 "	..
Cubit	..	..	48·6 "	47 "
Hand, length	..	..	19·8 "	18·8 "
" breadth	..	..	8·2 "	8·1 "
Middle finger	..	..	12·5 "	12 "
Hips	..	..	29·4 "	25·7 "

			Monegar aged 50-55.	Toda average.
Thigh (circumference) ..	..	..	53.5 cm.	..
Calf (circumference) ..	..	..	34.5 "	..
Foot, length ..	..	..	26.4 "	26.2 cm.
" breadth ..	..	..	10.1 "	9.2 "
Cephalic length ..	..	..	19.5 "	19.4 "
" breadth ..	..	..	15 "	14.2 "
Nasal height ..	..	..	5.5 "	4.7 "
" breadth ..	..	..	4.1 "	3.6 "
Bigoniac ..	..	..	10.5 "	9.6 "
Bizygomatic ..	..	..	13.6 "	12.7 "

As examples of Toda men who had reached advanced years, the two following were selected for record :—

4. Old man, who maintains that he is a centenarian. Bowed with age. Face wrinkled, and furrowed like a shrivelled apple. Teeth entire, but upper incisors and canines reduced to mere pegs. Says that he remembers, when he was a lad, sixty or seventy years ago, going to a great gathering of Todas at the house of Mr. Sullivan (one of the first Europeans who visited the Nilgiris), who explained to them that the Government was paternally inclined towards them.

5. Man said to be sixty years old, but looks many years older. Bowed with age. Face wrinkled and furrowed. Advanced arcus senilis. Teeth entire, and in good condition. Muscles wasted and flabby.

Hair of head long and wavy, white with scattered tufts of black. Moustache and beard white, with diffused black hairs. Eye-brows black with scattered white hairs; united across middle line by black and white hairs curving upwards. Hair on chest and shoulders white; on abdomen black with sparse white hairs. White hair on back above spine of scapula; black hairs over body of scapula; and below inferior angle. Extensor surface of upper extremities very hairy. Preponderance of black hairs on upper arm, and white on fore-arm. Abundant black hair in arm-pits. Legs very hairy on both extensor and flexor surfaces. Preponderance of white hair on front and outer side of upper leg. Black, with scattered white hairs, on back of upper leg, and both surfaces of lower leg.

6. Man. A dense growth of long straight hairs directed outwards on helix of both ears, bearing a striking resemblance to the hairy development on the helix of the common Madras bonnet monkey (*Macacus sinicus*).

The two following cases of young lads are not, for obvious reasons, included in the table of measurements, but I place them on record as they are characteristic :—

7. Boy, aged 12. Shock head of hair. Down on upper lip. No hairy development on body. (Hair, it is said, develops between the fourteenth and seventeenth years.) Wears steel bangle round right ankle. Learning Tamil, English, and simple arithmetic, etc., at Paikāra school.

Height 143·8 cm.

Chest 68·5 cm.

Shoulders 32·7 cm.

Foot, length 23·4 cm. ; max : breadth 8·3 cm.

8. Boy, aged 16. Hair of head black, long, and wavy. Long hairs directed upwards between bushy eye-brows. Down on upper lip, and hair developing on chin, not on body. Ears pierced.

Height 156 cm.

Weight 91·5 lb.

Shoulders 34·2 cm.

Chest 76 cm.

Cubit 44·5 cm.

Hand, length 17·5 cm. ; breadth 7·7 cm.

Hips 23·1 cm.

Foot, length 25·7 cm. ; max : breadth 18·7 cm.

Cephalic length 18·7 cm.

„ breadth 14·1 cm.

Nasal height 4·5 cm.

„ breadth 3·5 cm.

Bigoniac 9·2 cm.

Bizygomatic 12·3 cm.

The Toda women are much lighter in colour than the men, and the colour of the body has been aptly described as being of a *café-au-lait* tint, and the face a shade darker. The skin of the female children and young adults is often of a warm copper hue. Some of the young women, with their hair dressed in glossy ringlets, bright, glistening eyes, and white teeth, are distinctly good-looking (frontispiece) though the face is spoiled by the lips and mouth ; but both good looks and complexion are short-lived, and the women speedily degenerate into uncomely hags.

The female outer garment consists of a robe similar to that of the men, but worn differently, being thrown over both shoulders and clasped in front by the hand.



TODA MONEGAR.

The leading characteristics of the female sex, the system of tattooing, and decoration with ornaments, are summed up in the following descriptive cases:—

9. Girl, aged 17. Father Todi; married to a Kenna. One child (female) seven months old. A bright, good-looking, intelligent girl, of modest demeanour. Can read and write Tamil to a limited extent. Not tattooed.

Height 155 cm.

Weight 91 lbs.

Skin of a uniform warm copper hue, smooth, and dry. She looks very fair when contrasted with the surrounding men.

Hair black, parted in the middle, and worn in flowing ringlets, which fall over the shoulders and neck. Hair uniformly distributed, not tufted. Uses ghî (clarified butter) as pomatum. Possesses a looking glass. Either curls her hair herself, or gets a friend to do it.

Fine light hairs on back between shoulders, and on extensor surface of fore-arm.

Cephalic length 18·6 cm.; breadth 13·5 cm.

Face long, oval. Length from vertex to chin 20 cm. Bizygomatic 11·7 cm. Bigoniac 9·5 cm. Glabella smooth; superciliary ridges not pronounced. Chin round. Cheek bones not prominent. Lips medium, slightly everted. Not prognathous. Facial angle 69·5. Teeth white, and well shaped.

Eyes glistening, horizontal. Iris dark brown. Conjunctivæ clear, not injected. Long, black, silky eye-lashes.

Nose straight. Height 3·7 cm.; breadth 3·1 cm.

Ears not outstanding. Points well developed. Length 6 cm. Lobes detached, pierced and plugged with wood. Wears gold ear-rings on festive occasions.

Shoulders 34 cm.

Fingers delicate, tapering. Nails almond-shaped. Length of hand 17 cm.; breadth 7·5 cm. Length of middle finger 10·8 cm.

Foot well shaped. Length 23 cm.; max: breadth 8·2 cm.

Baby (named Latchmi) shaved on back part of top of head. Hair brought forward over forehead. Has round neck a silver chain in three strands, ornamented with current two-anna pieces and Arcot four-anna pieces.

10. Woman, aged 22. Sister of No. 1. Strong family likeness. Father and husband both Todis. Married between four and five years. One child (female), aged nine

months. Tattooed with three dots on back of left hand. Complexion dirty copper colour.

Hairs between shoulders, on extensor surface of upper and fore-arms, and legs. Wears silver necklet, ornamented with Arcot two-anna pieces; thread and silver armlets ornamented with cowry shells (*Cypræa moneta*) on right upper arm; thread armlet ornamented with cowries on left upper arm; glass bead bracelet on left fore-arm; brass ring on left ring finger; silver rings on right middle and ring fingers.

Lobules of ear attached, pierced. Ear-rings removed owing to grandmother's death.

11. Woman, aged 28, past her prime. Father a Kuttan; husband a Kenna. Three children (girls), of whom two are alive, aged eleven and eight.

Tattooed with a single dot on chin; rings and dots on chest (pl. XII, 2) outer side of upper arms (pl. XII, 3) back of left hand, below calves (pl. XII, 4) above ankles (pl. XII, 6) and across dorsum of feet (pl. XII, 5).

Wears thread armlet ornamented with young cowries on right fore-arm; thread armlet and two heavy ornamental brass armlets on left upper arm; ornamental brass bangle, and glass bead bracelet on left wrist; brass ring on left little finger; two steel rings on left ring finger; bead necklet ornamented with cowries.

12. Woman, aged 35. Father a Todi; husband a Pekkann. Five children (3 boys, 2 girls), all alive; youngest three years old. Tattooed as No. 2, but, in addition, with rows of dots and rings on back (pl. XII, 1).

Skin dry, muddy yellow brown.

Hair black. Hairs of head 65 cm. long (a record of length) falling over shoulders and back in ringlets. Slight moustache. Hair developed on extensor surface of upper and fore-arms, legs, and between shoulder blades, where there is profuse secretion of perspiration.

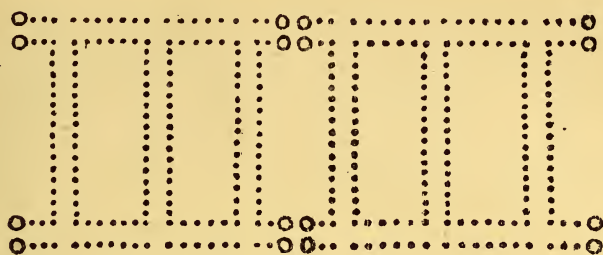
Height 152.4 cm.

Weight 108 lbs.

Cephalic length 19.3 cm.; breadth 13.6 cm.

Face. Wrinkles on forehead; superciliary ridges and glabella not marked. Eyebrows united across middle line by fine hairs. Cheek-bones rather prominent, with hollows beneath.

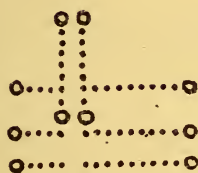
Nose straight. Height 4.1 cm.; breadth 3.5 cm. Ears not outstanding. Length 6.1 cm. Points well developed. Lobules attached, pierced. Possesses ear-rings, but will



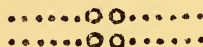
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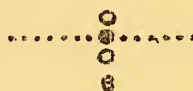
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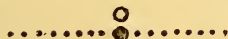
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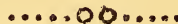
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7

not wear them until the dry funeral ceremony of an aunt, who died three months ago, has been performed.

Height from vertex to chin 21.5 cm. Bizygomatic breadth 12.2 cm. Bigonial breadth 9.2 cm.

Shoulders 34.2 cm.

Hand, length 17.5 cm.; breadth 7.8 cm. Length of middle finger 11 cm. Nails of left hand kept long for combing and scratching.

Foot, length 24.7 cm.; max: breadth 7.9 cm.

13. Woman aged 35. Father a Kuttan; husband a Kenna. Five children (3 boys, 2 girls) all alive; youngest eight years old. Tattooed as No. 4. Linen bound round elbow-joint to prevent chafing of heavy brass armlets. Cicatrices of sores in front of elbow-joint produced by armlets.

Rudimentary whiskers and moustache, and long, straggling hairs on chin. Abundant development of hair on extensor surface of fore-arms.

Conjunctivæ injected. Long hairs directed upwards, uniting eyebrows across middle line. Ears pierced. Lobules not attached.

14. Woman, aged 23. Father a Kuttan; husband a Pekkan. One child (boy) three years old. Tattooed only below calves, and above ankles.

Nose concave. Height 4.1 cm.; breadth 3.1 cm. Broad throughout, and flat across bridge. Breadth between inner ends of eye-brows 2.5 cm.

Upper eyelid turns down at inner angle, so as to partially cover caruncle.

Broad lower jaw; bigonial measuring 10 cm. (average = 9.4 cm).

15. Girl, aged 9-10. Hair in long curls (41 cm.), not shaved. Downy hairs on back, and extensor surface of fore-arm. Incipient moustache. Eye-brows united across middle line by long hairs directed upwards. Not reached puberty.

Height 134.6 cm.

Cephalic length 17.1 cm.

„ breadth 13.3 cm.

Bigonial 9.1 cm.

Bizygomatic 10.8 cm.

Nasal height 3.6 cm.

„ breadth 2.8 cm.

Shoulders 28.7 cm.

Span of arms 136.4 cm.

Cubit 36.5 cm.

Hand, length 14.8 c.m.

„ breadth 6.1 c.m.

Middle finger 9.4 c.m.

Foot length 20.5 c.m.

„ breadth 5.9 c.m.

The odorous abode of the Todas is called a mand (village or hamlet) which is composed of huts, Dwelling places. dairy temple, and cattle-pen, and has been so well described by Dr. Shortt, that I cannot do better than quote his account verbatim. "Each mand," he says, "usually comprises about five buildings or huts, three of which are used as dwellings, one as a dairy, and the other for sheltering the calves at night. These huts form a peculiar kind of oval pent-shaped construction, usually 10 feet high, 18 feet long, and 9 feet broad. The entrance or doorway measures 32 inches in height and 18 inches in width, and is not provided with any door or gate; but the entrance is closed by means of a solid slab or plank of wood from 4 to 6 inches thick, and of sufficient dimensions to entirely block up the entrance. This sliding door is inside the hut, and so arranged and fixed on two stout stakes buried in the earth, and standing to the height of $2\frac{1}{2}$ to 3 feet, as to be easily moved to and fro. There are no other openings or outlets of any kind either for the escape of smoke or for the free ingress and egress of atmospheric air. The doorway itself is of such small dimensions that, to effect an entrance, one has to go down on all fours, and even then much wriggling is necessary before an entrance effected. The houses are neat in appearance, and are built of bamboos closely laid together, fastened with rattan, and covered with thatch which renders them water-tight. Each building has an end walling before and behind, composed of solid blocks of wood, and the sides are covered in by the pent-roofing which slopes down to the ground. The front wall or planking contains the entrance or doorway. The inside of a hut is from 8 to 15 feet square, and is sufficiently high in the middle to admit of a tall man moving about with comfort. On one side there is a raised platform or pial formed of clay, about 2 feet high, and covered with sambar (deer) or buffalo skins, or sometimes with a mat. This platform is used as a sleeping place. On the opposite side is a fire-place, and a slight elevation on which the cooking utensils are placed. In this part of the building faggots of firewood

are seen piled up from floor to roof, and secured in their place by loops of rattan. Here also the rice-pounder or pestle is fixed. The mortar is formed by a hole dug in the ground, 7 to 9 inches deep, and hardened by constant use. The other household goods consist of 3 or 4 brass dishes or plates, several bamboo measures, and sometimes a hatchet. Each hut or dwelling is surrounded by an enclosure or wall formed of loose stones piled up 2 to 3 feet high, and includes a space or yard measuring 13×10 feet.

"The dairy, which is also the temple of the mand, is sometimes a building slightly larger than the others, and usually contains two compartments separated by a centre planking. One part of the dairy is a store-house for ghee, milk and curds, contained in separate vessels. The outer apartment forms the dwelling place of the pujāri or pālkārpāl (dairy priest). The doorways of the dairy are smaller than those of the dwelling huts, being 14×18 inches. The dairy or temple is usually situated at some little distance from the habitations, and strangers never attempt to approach too near it for fear of incurring the ill-will of the deity who is believed to preside within. Females are excluded, and the only parties who are free to come and go are the boys of the family. The flooring of the dairy is level, and at one end there is a fire place. Two or three milk pails or pots are all that it usually contains.

"The huts where the calves are kept are simple buildings somewhat like the dwelling huts.

"In the vicinity of the mands are the cattle-pens or tuel, which are circular enclosures surrounded by a loose stone wall with a single entrance guarded by powerful wooden stakes. In these the herds of buffaloes are kept at night. Each mand possesses a herd of these animals."

When a girl has reached the age of puberty, she goes through an initiatory ceremony, and a man of strong physique decides whether she is fit to enter into the married state. The selected man may subsequently marry the girl, or she may marry some one else, whom she accepts as meeting with her approbation. A man who is betrothed to a girl may enjoy conjugal rights before marriage with a view to testing mutual liking or dislike before it is too late, but may not live in the same hut with her.

No precautions are adopted to guard against pregnancy, and it is not viewed as a scandal if a girl becomes pregnant

before marriage. If a man suspects his fiancée of being pregnant by another, he may break off the engagement. The suspected man, if convicted, is not obliged to marry her.

It appears to be regarded as a mild disgrace if a child is born before marriage, but the girl is not banished from her mand.

If a married woman is found to be unfaithful to her husband, he may obtain a divorce, which is decreed by a panchāyat, or council, of Todas (a rudimentary type of judge and jury), and send her back to her parents. She is permitted to marry again, provided that her new husband makes good, in money or buffaloes, the expenses incurred in connection with the first marriage ceremony. In case of adultery, when punishment short of divorce is desired, a fine of a buffalo may be inflicted by the panchāyat, before whom the case comes up for hearing.

It is considered a disgrace for a woman not to get married, and, if she does not succeed in securing a husband by the natural process of sexual selection, her father bribes a man to marry her by a present of a buffalo. In ordinary marriages the bride's father receives a dowry of five rupees from the bridegroom-elect.

It is not looked on as a disgrace for a woman to be barren, but is attributed to bad luck, which may be remedied by prayers and propitiatory offerings to the swāmi. If satisfied that his wife is barren, a man may take unto himself a second wife, and live with both in one hut. Or his original wife may re-marry, if she can find a man ready to take her, provided that the expenses of her marriage with her first husband are refunded or made good, and jewelry returned.

When a woman is left a widow (barudi) she may live with her sons, if grown up and capable of supporting her, or with a married daughter, if her husband does not object to the constant presence of his mother-in-law. If she is left with young children, she returns to her parents. Widows are permitted to marry again. The name barudi, it may be noted, is applied to old women, widows, and barren women.

No test of virility or physical fitness is required of young men before entering into the married state, and no operation, *e.g.*, circumcision, is performed.

Girls are said to reach puberty between the ages of ten and twelve, and frequently 'join their husband' (to use the Toda phrase) about a year later.



TODA WOMAN.

During menstruation a woman lives apart in a separate hut. No purificatory ceremonies are performed.

When a woman discovers that she is pregnant with her first child, she removes the tali (marriage badge) from her neck, and puts it aside until the ceremony in celebration of the fifth month of her pregnancy called *purs yet pimmi*. To witness this, Todas are invited to the mand, and feasted on rice, milk, and molasses (jaggery). The woman's father promises his son-in-law a buffalo by name, which is sent as a present subsequently. Husband and wife then go to the forest, accompanied by their relatives and guests, and the husband sets off in search of a blade of grass and twig of a shrub (*Sophora glauca*), while the woman remains seated at the foot of a nāga tree (*Eugenia Arnottiana*) near which a rude temporary hut has been erected. A triangular hole is cut in the tree a few feet above the ground, and a lighted lamp placed in the hole. The husband then asks his father-in-law, *purs pul godvayi*, 'Shall I tie the tali?' and, on receiving assent to do so, places it round his wife's neck, and gives the grass and twig to her. After raising them to her head, the woman places them against the tree, under the lamp, and stands facing towards the tree until the lamp goes out. Meanwhile her husband ties up in a cloth some rāgi (*Eleusine Corocana*) wheat, honey, sāmāi (*Panicum miliare*) and gram (*Cicer arietinum*), and places them in a round hole in the tree beneath the lamp. He then prepares a meal for himself and his wife, which they partake of separately towards evening. The other Todas return to the husband's mand, where they "dine and sleep," going on the following morning to the forest to bring back the man and his wife to the mand.

The twig and grass used in the above ceremony are made to represent a bow and arrow, and are, according to Mr. Natesa Sastri, placed in the niche along with the light, and the husband and wife observe it minutely for an hour. The bow and string in the form of a circle are afterwards tied round the neck of the woman, who is from this minute the recognised wife of the Toda who married her. The primitive marriage badge made from what the forest affords is retained only during that night. It is next morning replaced by a silver badge called kyavilli, between Rs. 30 and Rs. 50 in value.

"At any time before the birth of a child is expected, the husband or wife may sever their relationship from each other by a panchāyat or council of elders, and by returning the *put kudivan* with any presents that one party has received from

another. Generally the presents do not take place till after a child is expected. When such an event seems certain, a ceremony called the *ur vot pimmi* takes place. This means the banishment from the house. On the first new moon day after this a spot is cleared out near the puzhar, in which rice with molasses is cooked in a new pot. An elderly woman rolls up a rag to the size of a small wick, dips it in oil, lights it up, and with the burning end scalds the woman's hands in four places—one dot at each of the lowest joints of the right and left thumbs, and one dot on each of the wrists. Then two stumps a foot high of the puvvu tree—(*Rhododendron arboreum*)—are prepared and rolled up in a black cumbly (a rough woollen cloth). These two stumps are called pirinbon and pirivon—he and she devils. Between these two a lamp is placed on the ground, and lighted. Two balls of rice cooked in the new pot near the puzhar are then brought, and placed before the pirinbon and pirivon on a kakonda leaf. The top of the balls are hollowed, and ghee is profusely poured into each while the following incantation is repeated :—pirinbon pirivon podya—may the he-devil and the she-devil eat this offering! This is something like the *bhūtabali* offered by the Hindus to propitiate the evil deities. After this offering the woman takes her food, and continues to live for one month in the puzhar till the next new moon, when she is again brought back to her own mand.” (S.M. Natesa Sastri.)

A pregnant woman continues to live in the same hut as her husband until the time of delivery, and is then removed to a hut called puzhar, set apart for the purpose at a short distance from the mand, unless the mand possesses a boath (see p. 173), in which case the hut is situated at a distance of about two miles from the mand.

A woman skilled in the duties of a midwife from the same or some other mand tends the parturient woman. If the midwife is a near relative, no remuneration is awarded in return for her services; otherwise she receives board and lodging, and a present of a new putkūli. The woman's husband is not admitted into the hut during the time of delivery.

The woman is delivered on her hands and knees, or lying backwards, supported on her hands. Death during, or as a sequel of parturition, is said to be very rare. The umbilical cord is tied and cut.

If the child is born dead, or dies before it has taken the breast, it is buried. If, however, it has taken the breast, it is burned, and both green and dry ceremonies are performed.



TODA GIRL.

On the day after delivery, or as soon after as possible, a young buffalo calf is brought in front of the puzhar, and the father of the new-born babe goes to the forest to make two new bamboo measures. The woman comes out of the hut with her infant, and sits at a distance of some yards from the calf. The husband on his return fills one, and half fills the other measure with water. Holding the measure which is half full on the right side of the calf's hind-quarters, he pours water from the measure which is full down the animal's back, so that some of it trickles into the other measure. A Toda, who has obtained from the jungle a leaf of the pālai tree (*Mappia foetida*), places it in the hands of the woman. Her husband then pours water from one of the measures into the leaf, of which the woman drinks, and, if the child is a girl, puts a drop of water into its mouth. Man and wife, with the child, then return to the puzhar⁷ where they live till the next new moon, when they return to their hut in the mand. A buffalo is then milked by a Toda belonging to the Pekkan clan. A leaf of the pālai tree is placed in the woman's hand, and milk is poured into it by a female relative, and drunk by the woman. In the evening a feast is given to the Todas who have been present at the returning home ceremony.

When the child has reached the third month of its existence,⁸ it is, if a boy, taken by its father, unaccompanied by its mother, early in the morning to the dairy temple (pālchi) of the mand, before which the father prostrates himself, and offers up prayers to the swāmi. The child is named by a relative, *e.g.*, its maternal uncle or grand-father, after a relative, god, buffalo, mountain peak, &c., but in after life a nick name, sometimes indecent, is given. "They have," a friend writes to me, "curious nick names, these Todas. One little lad went by the name of 'Kacleri,' *i.e.*, public office. His elder brother, who was celebrated in the mand for his rendering of an interminable Badaga song, of which, one Rāman—a veritable Launcelot—was the hero, rejoiced in the title of 'Sirkar,' *i.e.*, Government." The simple baptism ceremony is followed by a feast, of which the inhabitants of the mand take part. If the child is a girl, it is not taken to the pālchi, but is merely named by its father.

⁷ According to another version, the husband returns to his own hut, and does not live in the puzhar.

⁸ Fortieth day according to another version.

The foregoing account of the *post partum* and naming ceremonies is recorded as it was narrated to me; but they are treated of more fully by Mr. Natesa Sastri, who no doubt had greater ease than a European in eliciting information, and from whose account the following extract is taken :—

“As soon as the child is born, the mother and baby are taken to a temporary hut (mand) built of sticks in a semi-circular form near a place in the general mand from which the Todas get their water-supply. A she-buffalo calf is brought before this hut, and the father of the child pours water on the left side of the calf between two sticks of the Nilgiri reed called odai, and the water is then collected in the hollow of a third reed stick. Then the mother and her new-born baby are made to sit in the temporary hut, and a leaf of kakonda tree (*Mappia fatida*), is placed on their heads, and the collected water in the reed is poured on the leaf with the following incantation :—*Podar ner als pimi*—I pour the sacred water over you. This answers to the jatakarmam of the Hindu, which should be performed as soon as the child is born, though it is the custom now-a-days to reserve this to a latter date. After this the mother and baby retire to the puzhar, where they live till the next new moon. On the morning of the new moon day all the buffaloes in the mand are milked, and the collected milk is kept without being used by anybody. At twilight the same evening, after all the cattle have been penned, an elderly woman in the mand proceeds to the puzhar with a little milk in her hand in a vessel called nak (alak?) to bring the mother and baby to the father's house. A single leaf of the kakonda tree is given to the mother, which she holds in the form of a cup. The old woman pours into it three drops of milk. Each time a drop is poured, the mother raises the cup to her forehead, touches her hair with it, and drinks it off. Then the old woman conducts the mother and baby home, which is lighted up. From this moment the woman and the baby become members of the family. The Toda baby boy is wrapped up in a thick cotton cloth, called duppatti, and the face is never shown to any one. The mother feeds it till it is three months old. At the end of the third month a curious ceremony takes place called *mutarderd pimmi*, or opening the face ceremony, and it is as follows. Just before dawn on the third new moon day after the birth of the child, the father, who has not seen its face till then, takes it to the temple in the mand—the sacred dairy or palchi—and worships at the door as follows :—

Vishzht tomma—May the child be all right!

Tann nimma—May God protect him!

Sembor kumma—May he give him life!

“After this prayer the father returns home with the child, and from this minute the wrapping up of the child’s face ceases, and every one can look at it.

“If the maternal uncle of the child is present, another ceremony is also conjoined with *mutarderd pimmi*. It is the giving of a name to the boy allied to the *namakarana* of the Hindus.

“The ceremony of naming is called *tezhantu pimmi*. The uncle gives a name, and that is all. Then the ends of the hair of the baby are cut. A wild rose stick, called by the Toda kodag (*Rosa leschnaultiana*), is brought from the forest, the hair of the boy is placed on it, and with a sharp knife the edges that rest on the stick are cut off, and carefully preserved in a piece of cloth or paper tightly tied, and locked up in a box for three years. The reason for this, the Toda says, is that, if the bits are thrown away, and are used by the crows in building their nests, the head of the boy will never rest firm on his shoulders, but will always be shaky. After three years a deep pit is dug outside the limits of the mand, and the hair so carefully preserved is buried in it very carefully beyond the reach of the dreaded crow. When the boy is three years and three months old, the head is shaved, three locks of hair only being preserved. Two locks on the forehead are called *meguti*, and the third lock on the back of the head is called *kut*. This ceremony is called *kut mad vas pimmi*. All these rites are common to both male and female children born in a family. If the female child has an elder brother, she wears only the two front locks without the back one. If she is the first female child in the family—first in order of birth, or first surviving—she wears all the three locks.”

Women are said to suckle their children from one to two years on an average.

There is no superstition in connection with the birth of twins, though one man, whom I questioned on the subject, was inclined to attribute the dual birth to the practice of polyandry; and I was reminded of the reply of a Ceylonese native to Professor Haeckel:—“These people have always had a number of fathers, and, as they inherit all the bad qualities of so many fathers, it is only natural that they should grow worse and worse.”

In ‘the Tribes inhabiting the Neilgherry hills,’ 1856, by a German missionary, it is stated that “it is rarely that there

are more than two or three children, and it is not at all an uncommon thing to find only a single child, while many families have none at all." Studied with reference to the above observation, which, it must be borne in mind, was written thirty-six years ago, the following statistics, gleaned in the course of my enquiries, are not without interest :—

Age of woman.	Male issue.	Female issue.	Remarks.
17	...	1	Seven months old.
25	2	1	Girl dead.
28	...	3	Two living, aged twelve and eight.
35	3	2	Youngest two years old. All living.
40	2	5	One male, two females, alive. Youngest aged twelve.
28	4	...	Two alive, aged six and a year and a half.
22	...	1	Nine months old.
30	1	4	All dead, except eldest girl aged twelve.
23	...	2	Both dead.
23	1	...	Three years old.
30	...	4	Youngest six years old. All living.
40	5	5	Only one alive, a female twenty-five years old (probably syphilitic).
30	1	1	Boy alive, six years old.
30	2	2	Youngest four years old. All living.
30	1	...	Eight months old.
35	3	2	Youngest eight years old. All living.
26	2	...	Youngest two years old. Both alive.
30	2	1	Youngest six years old. All living.
26	...	...	} No issue.
28	...	...
30	...	...
29 (20 living)	34 (19 living)		



TODA MAN.

The Todas are endogamous as a tribe, and even as regards intermarriage of clans. some of the five clans, viz., Kenna, Kuttan, Paiki, Pekkan and Todi, into which they are subdivided. Members of the different clans have no distinguishing dress or mark. Intermarriage between Paiki and Pekkan is said to be forbidden, but the remaining clans intermarry freely. Of twenty-seven cases examined by me, husband and wife belonged, as shown by the following tabular statement, to different clans in twenty-four, and to the same clan (Todi) in three cases only—figures which, as the cases were taken at random, demonstrate the prevalence of the custom of intermarriage between members of different clans :—

Husband.	Wife.	Number of cases.
Kenna.	Todi.	7
Kenna.	Kuttan.	2
Kuttan.	Kenna.	2
Kuttan.	Todi.	1
Paiki.	Todi.	1
Pekkan.	Kuttan.	1
Pekkan.	Todi.	2
Todi.	Kenna.	4
Todi.	Kuttan.	3
Todi.	Pekkan.	1
Todi.	Todi.	3

Brecks states that “ Todas are divided into two classes, which cannot intermarry, viz. :—

- (1) Dêvalyâl.
- (2) Tarserzhâl.

“ The first class consists of the Peiki clan, corresponding in some respects to Brahmans; the second of the four remaining clans, the Pekkan, Kuttan, Kenna and Todi.

“ The Peikis eat apart; and a Peiki woman may not go to a village of the Tarserzhâl, although the women of the latter may visit Peikis.”

In the course of my enquiries, two different stories were told in connection with the marriage of Paikis, and the classes into which the Todas are divided. According to one story, Paikis may become either pâlâls or kâltamâks (herdsmen of the tiriêri), and a Paiki who has a right to become a kâltamâk may marry into another clan, whereas a Paiki who has a right to become a pâlâl may only marry into his own clan.

One girl I saw, a thirteen-year old bride of three months standing, belonging to the Todi clan, whose husband, a Paiki, had an hereditary right to become a kältamāk. According to the other story, Todas are divided into two classes, Tértāl and Tärtāl, of which the former comprises superior Paikis who may become pālāls or kältamāks, and are only permitted to marry into their own clan; and the latter comprises Todis, Kennas, Kuttans, Pekkans, and inferior Paikis, who may marry into other clans, and cannot become either pālāls or kältamāks. The man who gave me the latter version informed me further that, when a funeral ceremony is going on in the house of a Tértāl, no Tärtāl is allowed to approach the mand; and that, when a Tértāl woman visits her friends at a Tärtāl mand, she is not allowed to enter the mand, but must stop at a distance from it. Todas as a rule cook their rice in butter milk, but, when a Tértāl woman pays a visit to a Tärtāl mand, rice is cooked for her in water. When a Tärtāl woman visits at a Tértāl mand, she is permitted to enter into the mand, and food is cooked for her in butter milk. Males of either class may enter freely into the mands of the other class. The restrictions which are imposed on Tértāl women are said to be due to the fact that on one occasion a Tértāl woman, on a visit at a Tärtāl mand, folded up a cloth, and placed it under her putkūli as if it was a baby. When food was served, she asked for some for the child, and, on receiving it, exhibited the cloth. The Tärtāls, not appreciating the mild joke, accordingly agreed to degrade all Tértāl women.

The religion of the Todas may be briefly summed up as
 Religion. being a simple faith handed down from generation to generation, adulterated, in modern times, with an admixture of Hinduism. They worship Kadavul, the creator of the earth and sky, to whom they pray night and morning that he will protect their cattle, their wives and families. They also worship the rising (but not the setting) sun, and the moon. They believe that the souls of the departed go, accompanied by the souls of the buffaloes killed at their funeral, to heaven (āmñād) over Makurti peak, and that one who has led a good life will there have enjoyment, and one who has led a bad life will suffer punishment. They believe, in a half-hearted manner, the story handed down from their ancestors that on the road to heaven there is a river full of leeches (familiar pests to them during the rainy season), which has to be crossed by a thread, which will break beneath the

weight of a bad man and plunge him into hell (pūfērigēn),⁹ but will carry a good man safely across. They believe further that a man who has led a bad life on earth returns thither in the guise of a giant or demon, who goes about killing Todas and other races. A good man is, in the Toda estimation, one who is given to deeds of charity, and a bad man one who is uncharitable (this in order of precedence), quarrelsome, thieving, &c.

One woman I saw, who was unable to come and have her measurements recorded, as she was pregnant, and could not cross the bridge which spanned the intervening Paikāra river ; to cross the running water during pregnancy being forbidden by the swāmi (god) who presides over the river. Another woman wore round her neck a copper plate wound into a spiral, on which mantras were inscribed. She had suffered, she informed me, from evil dreams when laid up with fever, and wore the plate to keep away dreams and threatenings from devils.

The Todas reverence especially the hunting god Bētakan (who was the son of Dirkhish, who was the son of En, who was the first Toda), who has a temple—Bētakan swāmi kōvil—at Nambalakōd in the Wynād, and Hiriadēva, the bell-cow god, whose temple is at Mēlur, where Badagas perform the quaint and picturesque ceremony of walking through fire. They worship also the Hindu god Ranganātha at the temples at Nanjengōd in Mysore, and Karamaddi, near Mettupalaiyam, at the base of the hills, offering up cocoanuts, plantains, &c. If a woman is barren, the husband, with or without his wife, makes a pilgrimage to the temple, and prays to the swāmi to give them offspring. My informant, whose wife had born him no children, had gone to the temple at Nanjengōd about six months previously, and his wife was five months pregnant. The reputation of the shrine was consequently much enhanced, the woman's pregnancy being attributed to the intervention of the lingam (the phallic emblem).

A man who came to my laboratory had his hair hanging down in long tails reaching below his shoulders. He had, he told me, let it grow long, because, though married to him five years, his wife had presented him with no child. A child had, however, recently been born, and as soon as the dry funeral (kēdu) of a relation had been performed, he was going to sacrifice his locks as a thank-offering at the Nanjengōd shrine, where both Todas and Badagas worship.

⁹ Pūf, leech ; ēri, place ; gen, water.

So far as I have been able to ascertain, the Todas have only one purely religious ceremonial, which takes the form of a buffalo sacrifice, and is called *kona shastra*. This ceremony is said to be performed once in four or five years,¹⁰ with a view to propitiating the gods, so that they may bring good luck to the Todas, and make their buffaloes yield milk in abundance. A round hole is dug in the ground, and filled with salt and water, which is drunk by the grown up buffaloes and a selected buffalo belonging to the mand which is celebrating the rite. The Toda men (women are not permitted to take part in the ceremony) who have been invited to be present are then fed. The buffalo calf is killed by a priest (*varzhāl* or *pālikarpāl*), clad in a black *putkūli* round the waist, by a blow on the head with a stick made from a bough of the sacred *tūd* tree (*Meliosma pungens*). The assembled Todas then salute the dead animal by placing their foreheads on its head. The flesh, I was informed, is given to Kotas, but Breeks¹¹ states that "the flesh must not be boiled, but roasted on a fire, made by rubbing together two sticks of the *neralu*, *muthu*, or *kem* trees, and eaten by the celebrants."

Writing in 1872, Breeks remarked¹² that "about Ootacamund a few Todas have latterly begun to imitate the religious practices of their native neighbours. Occasionally children's foreheads are marked with the *Sīva* spot, and my particular friend *Kinniaven*, after an absence of some days, returned with a shaven head from a visit to the temple of *Sīva* at *Nanjangudi*." The following extracts from my notes will serve to illustrate the practice of marking (which seems to be done in some instances 'for beauty's sake,' and not from any religious motive) and shaving as carried out at the present day.

1. Man, aged 28. Has just performed a religious ceremony at the *tiriēri* (temple). White curved line painted across forehead, and dots below outer ends of curved line, glabella, and outside orbits (a common type of *Badaga* sect on mark). Smeared across chest, over outer side of upper arms and left nipple, across knuckles and lower end of left ulna, and on lobes of ears.

2. Man, aged 21. Painted on forehead as above. Smeared over chest and upper eye lids.

¹⁰ According to Breeks (*Primitive Tribes of the Nilagiris*) an annual ceremony.

¹¹ *Op. cit.*

¹² *Op. cit.*



TODA MAN.

3. Man, aged 35. White spot painted on forehead.
4. Man, aged 30. Hair of head and beard cut short owing to death of grandfather.
5. Boy, aged 12. Shock-head of hair, cut very short all over owing to death of grandfather.
6. Girl, aged 8. Hair shaved on top, back and sides of head behind ears, and in median strip from vertex to forehead. Wavy curls hanging down back and side of neck.
7. Boy, aged 6. White spot painted between eyebrows. Hair shaved on top and sides of head, and in median strip from vertex to forehead. Hair brought forward in fringe over forehead on either side of median strip, and hanging down back of neck. [This boy's cephalic length was very large for his age, being the same as the average length of the adult Toda woman's head (18·4 cm.).]
8. Male child, aged 18 months. White spot painted between eyebrows. Shaved on top and sides of head. Hair brownish-black, wavy.

The Toda priesthood includes five kinds of priests (dairy-men), who rank as follows in order of precedence :—

Priesthood.

- (1) Pālāl (priests of the tiriēris).
- (2) Vorzhāl.
- (3) Kokvalikarpāl (at the Tārnat mand).
- (4) Kurpulikarpāl (at the Kāndal mand).
- (5) Pālkarpāl (called Tarvēlikarpāl at the Tārnat mand).

Pālāl and Tiriēri.—We visited a tiriēri (dairy temple or lactarium) at Paikāra by appointment, and on arrival near the holy spot, found the two pālāls (monks), well built men aged about thirty and fifty, respectively, clad in black cloths, and two kāltamāks (herdsmen)—youths aged about eight and ten—naked save for a langūti, seated on the ground, awaiting our arrival. As a mark of respect to the pālāls the three Todas who accompanied us arranged their putkūlis so that the right arm was laid bare, and one of them, who had assumed a turban in honour of his appointment as my guide, removed the offending head-gear. A long palaver ensued in consequence of the pālāls demanding ten rupees to cover the expenses of the purificatory ceremonies which, they maintained, would be necessary if I desecrated the tiriēri by photographing it. Eventually, however, under promise of a far smaller sum, the tiriēri was

successfully photographed with pālāls, kāltamāks, and a domestic cat seated in front of it.

A typical tiriēri comprises a dwelling hut for the pālāls, a separate hut for the kāltamāks, a large and small cattle-pen (the latter for cow buffaloes in milk) for the sacred herd (swāmi mārdū), and tiriēri, or dairy temple, which contains the sacred bell (māni) and dairy appliances. No Todas, except pālāls and kāltamāks, are allowed within the tiriēri grounds.

The bell-cow is more sacred than the other members of the herd. On the decease of a bell-cow, the bell descends to her daughter, or, if she leaves no female offspring, a cow is brought from another tiriēri. The bell-cow does not usually wear the bell, but does so when a move is made to a distant tiriēri, for the periodical change of pasture-ground.

I interviewed a man, aged thirty-two, who had formerly been a pālāl for four years, but, getting tired of celibate existence, resigned his appointment so as to take a wife to himself. He had recently been to Nanjengōd to pray for a child to be given to him. His wife was pregnant, and his hair long, and hanging down below his shoulders. He told me that when the child was born, he would offer up thanks at the Nanjengōd shrine, have his hair cut, and give a meal to a hundred Badagas and others.

When a Toda is about to become a pālāl, he lives in the forest for two or three days and nights, naked except for a langūti, feeds on one meal of rice daily, and is allowed a fire to protect him from the cold night air. Many times during the two or three days he drinks, from a cup made of leaves, the juice of the bark of the tūd tree (*Meliosma pungens*) obtained by hitting the bark with a stone. On the last day of retreat puja is done to a black cloth—the distinguishing garb of a pālāl—which is carried by kāltamāks to the forest, and given to the novice, who spreads it on the ground, pours tūd juice on it, and utters mantras over it, and goes clad in it direct to the tiriēri.

Before becoming a pālāl, a man must obtain sanction to hold office from a pānchāyat of leading Todas, who decide on his fitness to enter on the sacred duties. During the absence of a pālāl, if married, from his wife, she may be supported by her husband's brother, or by her sons, or is placed under the charge of a man (not of necessity a relative) deputed by the pālāl, who defrays expenses, to take care of her, while he is off duty in his capacity as husband. A pālāl may resign office whenever he likes, on receipt of

permission from a pāṇchāyat to do so; but eighteen years formerly, and ten to twelve years at the present day, are, I am told, the maximum time of service. On resigning, he returns to his mand, and is no longer regarded as a swāmi, descending abruptly from god-head to the routine life of a common Toda.

When a man or youth is about to become a kāltamāk, he retires for a day and night to the forest, naked save for a langūti, and on the following morning drinks some juice of the tūd tree, dons a white cloth, and is taken to the tiriēri. While within the precincts of the tiriēri, except in his own hut, he must go naked. No fixed time is allotted for service as a kāltamāk, and a kāltamāk may eventually become a pālāl.

The duties of a pālāl are as follows. Early in the morning he opens the cattle-pen, and sends the sacred herd out to graze, in the charge of the kāltamāk. After ablution, he enters within the tiriēri, and performs puja to the bell-god. About 7-30 or 8 A.M. he comes out of the tiriēri, ties a black cloth round his waist, and salutes the herd, which has returned from grazing, by raising his wand and bamboo measure (khāndi) to his head, and milks the cows. After milking, the buffaloes are again sent out to graze, and the milk is taken to the tiriēri, where further pujas are performed. On entering the tiriēri, the pālāl dips his fingers in milk three times, puts his fingers on the bell-god, and apparently utters the names of some gods, but my informant (an ex-pālāl) was hazy about their names. The morning meal is then cooked for both pālāl and kāltamāks. Every three or four days the pālāl makes butter and ney. Between 4 and 5 P.M. the buffaloes return home, and are penned for the night. Then follow more pujas, the evening meal, and retirement for the night.

On some days a pālāl may have to attend a pāṇchāyat at some distance from the tiriēri, whereat he acts as judge, enquiring into cases and delivering judgment, which is accepted by the other members of the pāṇchāyat. Or the members of the pāṇchāyat may assemble outside the precincts of the tiriēri, at some distance from the pālāl, but within range of hearing.

Milk, butter, and ney are purchased from the tiriēri by Todas and Badagas. The pālāl brings the buffalo produce outside the sacred precincts, keeping the intending purchasers at a distance, and, when he has returned to the

triëri, the produce is removed, and its value in money left in its stead.

If there are more bulls than are required in the sacred herd, the surplus stock is given as a perquisite to the kãl-tamãks, and sold to Badagas or Todas. The flesh of dead members of the herd is given as a present to Kotas.

The following information relating to the priests of the Kãndal and Tãrnãt mands was extracted with great difficulty.

At the Kãndal mand there are two dairy temples called kurpūli and orzhãlli. The priests are called kurpūlikãrpāl and vorzhāl. The former is a Kenna, paid six rupees per annum, and selected for office by the head-man of the mand. His duties are to graze and milk the buffaloes belonging to his temple, to make butter and ney, to distribute the produce among the inhabitants of the mand, and perform pujas in the temple. He is subject to the control of the head-man of the mand, and has to obey his orders to go to bazárs, villages, &c. The vorzhāl is also selected by the head-man of the mand, and must be a Paiki or Pekkan. He is paid six rupees per annum, and his duties are similar to those of the kurpūlikãrpāl, but he may not go away from the mand to bazárs or villages. During the absence of the kurpūlikãrpāl, he may milk the buffaloes of the kurpūli; but the kurpūlikãrpāl, being inferior in rank, is not allowed to milk the buffaloes of the orzhãlli. Neither of the two priests is bound to remain in office for a fixed time, but may resign on being relieved by a successor. So long as they remain in office, they are bound to a life of celibacy, but a married man may hold office, provided that he keeps apart from his wife.

At the Tãrnãt mand there are three dairy temples called kokvēli, tarvēli, and orzhãlli. The priests attached to the temples are called, respectively, kokvēlikãrpāl, tarvēlikãrpāl, and vorzhāl. Each temple has its own buffaloes. The kokvēlikãrpāl milks the buffaloes, and sells the produce apparently for his own benefit. He is only allowed to remain in office for three years and is succeeded by his brother; the office remaining, by hereditary right, in one family.

The tarvēlikãrpāl and vorzhāl milk the buffaloes belonging to their respective temples, and distribute the produce among the inhabitants of the mand. The vorzhāl is paid six rupees per annum. All three priests have to perform pujas in their temples in addition to dairy duties.



TODA BOY.

In addition to the pālchis and tiriēris the Todas keep up as dairy-temples certain edifices called boaths or boas. Of these curious structures there are four on the Nilgiri plateau, viz., at the Muttanād mand, near Kotagiri, near Sholūr, and at Mudi-mand. The last was out of repair in 1894, but was, I was informed, going to be rebuilt shortly.

The Boath.

It has been suggested by Colonel Marshall¹³ that the boath is not a true Toda building, but may be the bethel of some tribe contemporaneous with, and cognate to the Todas, which, taking refuge, like them, on these hills, died out in their presence; and he compares them with the buildings, similar to the bothan or bee-hive houses in Scotland, which were discovered by the Rev. F. W. Holland in his explorations in the peninsula of Sinai.

The boath which we visited near the Muttanād mand, at the top of the Sigūr ghāt, is known to members of the Ootacamund hunt as the Toda cathedral. It is a circular stone edifice, about 25 to 30 feet in height, with a thatched roof, and surrounded by a circular stone wall. The roof is crowned with a large flat stone. To penetrate within the sacred edifice was forbidden, but we were informed that it contains milking vessels, dairy apparatus, and a swāmi in the guise of a copper bell. Within the building no one is admitted except the pujāri (dairyman priest), who is called a vorzhāl. The present incumbent, who was out on the downs with the buffaloes at the time of our visit, was selected for office by the head-man of the village and his brother, and had been in office from ten to fifteen years.

In front of the cattle-pen of the neighbouring mand I noticed a grass covered mound, which, I was informed, is sacred. The mound contains nothing buried within it, but the bodies of the dead are placed near it, and earth from the mound placed on the corpse (dust to dust), which is then removed to the burning ground. At dry funerals the buffalo is slain near the mound.

On the death of a Toda, the corpse, clad in a new putkūli and decorated with jewelry, in which the sick person has been dressed up when signs of approaching dissolution set in, is laid out in the hut. Marshall narrates the story that a man who had revived from what was thought his death-bed has been observed

Death ceremonies.

¹³ *Op. cit.*

parading about, very proud and distinguished looking; wearing the finery with which he had been bedecked for his own funeral, and which he would be permitted to carry till he really departed this life. A lamp is kept burning in the hut, and camphor used as a disinfectant. The news of the death are conveyed to other mands, the inhabitants of which join with the relatives of the departed one in weeping and mourning. Those who come to pay their respects to the dead body commence the customary signs of active grief when they have arrived within a short distance of the hut, on entering which they place their head to the head, and then their feet to the feet of the corpse, and mourn in company with the relatives. On the day of death, none of the inhabitants of the mand, or visitors from other mands, are allowed to eat food. On the following day meals, prepared by near relatives of the deceased, are served in another hut. The near relatives are forbidden to eat rice, milk, honey, or gram, until the funeral is over, but may eat *rāgi*, *sāmai*, butter, and *ghī*. If the head-man of a mand dies, the sons, and, if the head-woman dies, the daughters have, I was told, to observe the same rules as to diet until the dry funeral is performed.

When a man dies, a bow and arrow obtained from the Kotas, his walking stick, jaggery, rice, honey, cocoanuts, plantains, tobacco, a bamboo *khāndi* (measure), and cowries, with which to purchase food in the celestial bazār, are burned with him. Bags of rupees are, as a mere form, placed on the funeral pyre, but removed before the flames reach them.

When a woman dies, cooking and household utensils, jewelry, and articles of food, thread, and cowries are burned, and bags of rupees placed on the pyre.

The remains of gold and silver jewelry are recovered from the ashes, and made up again into jewelry.

It was my good fortune to have an opportunity of witnessing the dry funeral ceremony (*kēdu*) of a woman who had died from small-pox two months previously. On arrival at a mand, on the open downs about five miles from Ootacamund, we were conducted by a Toda friend to the margin of a dense *shola*,¹⁴ (grove) where we found two groups seated apart, consisting of (a) women, girls, and brown-haired female babies, chat-

¹⁴ Owing to the performance of rites in sacred groves it has been suggested that the Toda religion is Druidical or Celto-druidical.



TODA MAN.

ting round a camp fire; (b) men, boys, and male babies carried, with marked signs of paternal affection, by their fathers. The warm copper hue of the little girls and young adults stood out in noticeable contrast to the dull, muddy complexion of the elder women.

In a few minutes a murmuring sound commenced in the centre of the female group. Working themselves up to the necessary pitch, some of the women (near relatives of the dead woman) commenced to cry freely, and the wailing and lachrymation gradually spread round the circle, until all, except little girls and babies who were too young to be affected, were weeping and moaning, some for fashion, others from genuine grief. The men meanwhile showed no signs of sorrow, but sat talking together, and expressed regret that we had not bought the hand dynamometer, to amuse them with trials of strength.

In carrying out the orthodox form of mourning, the women first had a good cry to themselves, and then, as their emotions became more intense, went round the circle, selecting partners with whom to share companionship in grief. Gradually the group resolved itself into couplets of mourners, each pair with their heads in close contact, and giving expression to their emotions in unison. Before separating, to select a new partner, each couple saluted by bowing the head and raising the feet of the other, covered by the putkūli, thereto.

From time to time the company of mourners was reinforced by late arrivals from distant mands, and, as each detachment, now of men, now of women, came in view across the open downs, one could not fail to be reminded of the gathering of the clans on some Highland moor. The resemblance was heightened by the distant sound as of pipers, produced by the Kota band (with two police constables in attendance), composed of four truculent-looking Kotas, who made a hideous noise with drums and flutes as they drew near the scene of action. The band, on arrival, took up a position close to the mourning women. As each detachment arrived, the women, recognising their relatives, came forward and saluted them in the manner customary among Todas by falling at their feet and placing first the right then the left foot on their head (ababuddiken).

Shortly after the arrival of the band, signals were exchanged, by waving of putkūlis, between the assembled throng and a small detachment of men some distance off. A general move was made, and an impromptu procession

formed, with men in front, band in the middle, and women bringing up the rear. A halt was made opposite a narrow gap leading into the shola; men and women sat apart as before, and the band walked round, discoursing unsweet music. A party of girls went off to bring fire from the spot just vacated for use in the coming ceremonial, but recourse was finally had to a box of tändstikers lent by one of our party. At this stage of the proceedings we noticed a woman go up to the eldest son of the deceased, who was seated apart from the other men crying bitterly, and would not be comforted in spite of her efforts to console him.

On receipt of a summons from within the shola, the assembled Toda men and ourselves swarmed into it by a narrow track leading to a small clear space around a big tree, from a hole cut at the base of which an elderly Toda produced a piece of the skull of the dead woman, wrapped round with long tresses of her hair. It now became the men's turn to exhibit active signs of grief, and all with one accord commenced to weep and mourn. Amid the scene of lamentation, the hair was slowly unwrapt from off the skull, and burned in an iron ladle, from which a smell as of incense arose. A bamboo pot of ghī (clarified butter) was produced, with which the skull was reverently anointed, and placed in a cloth spread on the ground. To this relic of the deceased the throng of men, amid a scene of wild excitement, made obeisance by kneeling down before it, and touching it with their foreheads. The females were not permitted to witness this stage of the proceedings, with the exception of one or two near relatives of the departed one, who supported themselves sobbing against the tree.

The ceremonial concluded, the fragment of skull, wrapt in the cloth, was carried into the open, where, as men and boys had previously done, women and girls made obeisance to it.

A procession was then again formed, and marched on until a place was reached, where were two stone-walled kraals, large and small. Around the former the men, and within the latter the women, took up their position, the men engaging in chit-chat, and the women in mourning, which after a time ceased, and they too engaged in conversation, one of their number (a Toda beauty) entertaining the rest by exhibiting a photograph of herself, with which I had presented her.

A party of men, carrying the skull, still in the cloth, set out for a neighbouring shola, where a kēdu of several

other dead Todas was being celebrated ; and a long pause ensued, broken eventually by the arrival of the other funeral party, the men advancing in several lines, with arms linked, keeping step and crying out ā !, u !, ā !, u !, in regular time. This party brought with it pieces of the skulls of a woman and two men, which were placed, wrapt in cloths, on the ground, saluted, and mourned over by the assembled multitude. At this stage a small party of Kotas arrived, and took up their position on a neighbouring hill, waiting, vulture-like, for the carcase of the buffalo which was shortly to be slain.

Several young men now went off across the hill in search of buffaloes, and speedily re-appeared, driving five buffaloes before them with sticks. As soon as the beasts approached a swampy marsh at the foot of the hill, on which the expectant crowd of men was gathered together, two young men of athletic build, throwing off their putkūlis, made a rush down the hill, and tried to seize one of the buffaloes by the horns, with the result that one of them was promptly thrown. The buffalo escaping, one of the remaining four was quickly caught by the horns, and, with arms interlocked, the men brought it down on its knees, amid a general scuffle. In spite of marked objection and strenuous resistance on the part of the animal—a barren cow—it was, by means of sticks freely applied, slowly dragged up the hill, preceded by the Kota band, and with the ‘third standard’ student pulling at its tail. Arrived at the open space between the two kraals, the buffalo, by this time thoroughly exasperated, and with blood pouring from its nostrils, had a cloth put on its back, and was despatched by a blow on the poll with an axe deftly wielded by a young and muscular man (pl. xv). On this occasion no one was badly hurt by the sacrificial cow, though one man was seen washing his legs in the swamp after the preliminary struggle with the beast ; but Colonel Ross-King narrates¹⁵ how he saw a man receive a dangerous wound in the neck from a thrust of the horn, which ripped open a wide gash from the collar bone to the ear.

With the death of the buffalo, the last scene which terminated the strange rites commenced ; men, women, and children pressing forward and jostling one another in their eagerness to salute the dead beast by placing their heads between its horns, and weeping and mourning in pairs ; the

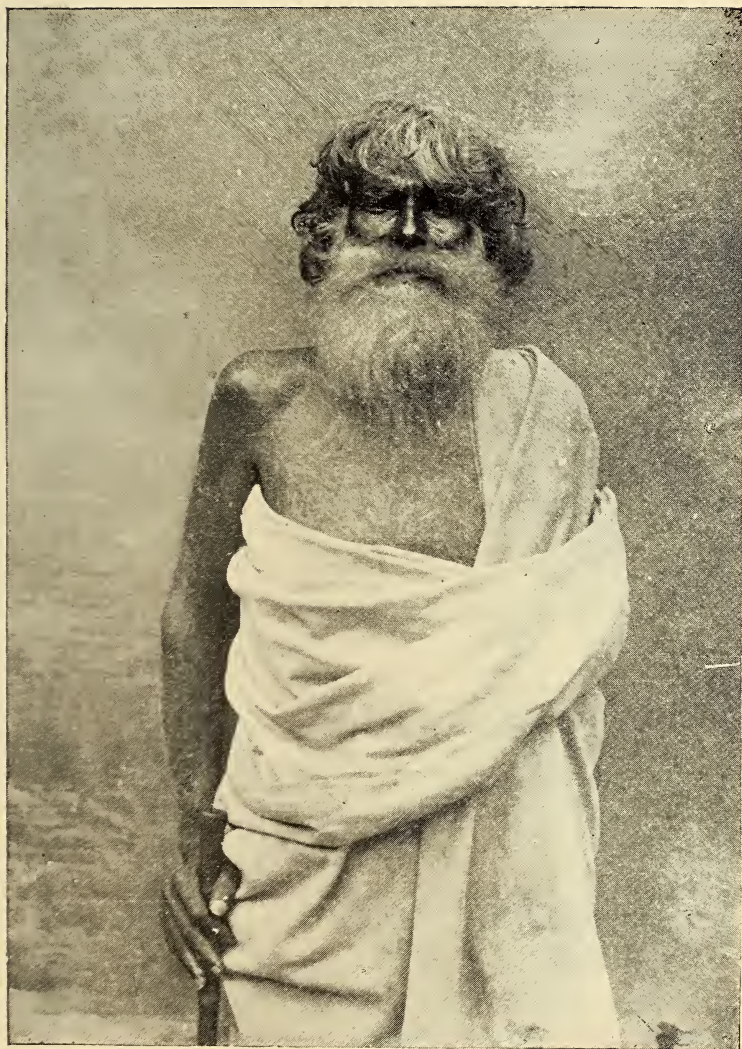
¹⁵ Aboriginal Tribes of the Nilgiri Hills, 1870.

facial expression of grief being mimicked when tears refused to flow spontaneously.

A few days after the kēdu ceremony we were invited to be present at the green funeral of a girl, five years old, who had died of small-pox four days previously. We proceeded accordingly to the scene of the recent ceremony, and there, in company with a small gathering of Todas from the neighbouring mands (among them the only white-haired old woman whom I have seen), awaited the arrival of the funeral cortège, the approach of which was announced by the advancing strains of Kota music. Slowly the procession came over the brow of the hill; the corpse, covered by a cloth, on a rude ladder-like bier, borne on the shoulders of four men, followed by two Kota musicians; the mother carried hidden within a sack; relatives and men carrying bags of rice and jaggery (molasses), and bundles of wood of the nāga tree (*Eugenia Arnottiana*) for the funeral pyre.

Arrived opposite a small hut, which had been specially built for the ceremonial, the corpse was removed from the bier, laid on the ground, face upwards, outside the hut, and saluted by men, women, and children, with same manifestations of grief as at the dry funeral. Soon the men moved away to a short distance, and engaged in quiet conversation, leaving the females to continue mourning round the corpse, interrupted from time to time by the arrival of detachments from distant mands, whose first duty was to salute the dead body. Meanwhile a near female relative of the dead child was busily engaged inside the hut, collecting together in a basket small measures of rice, jaggery, sago, honey-comb, and the girl's simple toys, which were subsequently to be burned with the corpse.

The mourning ceasing after a time, the corpse was placed inside the hut, and followed by the near relatives, who there continued to weep over it. A detachment of men and boys, who had set out in search of the buffaloes which were to be sacrificed, now returned driving before them three cows, which escaped from their pursuers to re-join the main herd. A long pause ensued, and, after a very prolonged drive, three more cows were guided into a swampy marsh, where one of them was caught by the horns as at the kēdu ceremony, and dragged reluctantly, but with little show of fight, to the weird strains of Kota drum and flute,



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in front of the hut, where it was promptly despatched by a blow on the poll.

The corpse was now brought from within the hut, and placed, face upwards, with its feet resting on the forehead of the buffalo, whose neck was decorated with a silver chain, such as is worn by Todas round the loins to suspend the langūti, as no bell was available, and the horns were smeared with butter. Then followed the same frantic manifestations of grief as at the kēdu, amid which the unhappy mother fainted from sheer exhaustion.

Mourning over, the corpse was made to go through a form of ceremony, resembling that which is performed at the fifth month of pregnancy with the first child. A small boy, three years old, was selected from among the relatives of the dead girl, and taken by his father in search of a certain grass and a twig of a shrub (*Sophora glauca*), which were brought to the spot where the corpse was lying. The mother of the dead child then withdrew one of its hands from the putkūli, and the boy placed the grass and twig in the hand, and limes, plantains, rice, jaggery, honey-comb, and butter in the pocket of the putkūli, which was then stitched with needle and thread in a circular pattern. The boy's father then took off his son's putkūli, and covered him with it from head to foot. Thus covered, the boy remained outside the hut till the morning of the morrow, watched through the night by near relatives of himself and his dead bride.

[On the occasion of the funeral of an unmarried lad, a girl is, in like manner selected, covered with her putkūli from head to foot, and a metal vessel, filled with jaggery, rice, etc. (to be subsequently burnt on the funeral pyre), placed for a short time within the folds of the putkūli. Thus covered, the girl remains till next morning, watched through the dreary hours of the night by relatives. The same ceremony is performed over the corpse of a married woman, who has not borne children, the husband acting as such for the last time, in the vain hope that the woman may produce issue in heaven.]

The quaint ceremonial concluded, the corpse was borne away to the burning-ground within the shola, and, after removal of some of the hair by the mother of the newly wedded boy, burned, with face turned upwards,¹⁶ amid

¹⁶ Marshall states that he was "careful to ascertain that the placing the body with its face downwards had not been an accidental circumstance."

the music of the Kota band, the groans of the assembled crowd squatting on the ground, and the genuine grief of the nearest relatives.

The burning concluded, a portion of the skull was removed from the ashes, and handed over to the recently made mother-in-law of the dead girl, and wrapped up with the hair in the bark of the tūd tree.

A second buffalo, which, properly speaking, should have been slain before the corpse was burnt, was then sacrificed, and rice and jaggery were distributed among the crowd, which dispersed, leaving behind the youthful widower and his custodians, who, after daybreak, partook of a meal of rice, and returned to their mands; the boy's mother taking with her the skull and hair to her mand, where it would remain until the celebration of the dry funeral.

No attention is paid to the ashes after cremation, but they are left to be scattered by the winds.

At the Muttanād mand we were
 Games. treated to an exhibition of the games
 in which adult males indulge.

In one of these, called narthpimi, a flat slab of stone is supported horizontally on two other slabs fixed perpendicularly in the ground so as to form a narrow tunnel, through which a man can just manage to squeeze his body with difficulty. Two men take part in the game, one stationing himself at a distance of about thirty yards, the other about sixty yards from the tunnel. The front man, throwing off his cloth, runs as hard as he can to the tunnel, pursued by the 'scratch' man, whose object is to touch the other man's feet before he has wriggled himself through the tunnel.

Another game, which we witnessed, consists of trials of strength with a very heavy stone, the object being to raise it up to the shoulder; but a strong, well-built man—he who was entrusted with slaying the buffalo at the kēdu—failed to raise it higher than the pit of his stomach, though straining his muscles in the attempt. An old man assured us that, when young and lusty, he was able to accomplish the feat.

A still further game (ilāta) corresponds to the English tip-cat, which is epidemic at a certain season in the London bye-streets. It is played with a bat like a broom-stick, and a cylindrical piece of wood pointed at both ends. This piece of wood is propped up against a stone, and struck with the bat. As it flies up off the stone, it is hit to a distance with the bat, and caught (or missed) by the out-fields. At this game my Toda guide was very expert.

Brecks mentions that the Todas play a game resembling 'puss in the corner' and called *kāriālapimi*, which was not included in the programme of sports got up for our benefit.

We gave a demonstration of 'putting the stone,' and, if some future anthropologist finds this to be one of the Toda athletic sports, he must attribute its introduction to direct British influence.

I was informed that, in former times, certain men among the Todas were credited with the
 Medicinal. power to cast out devils by treatment with herbs, and that devils are still cast out of Todas who are possessed with them by certain Badaga and Hindu exorcists. The Todas treat mild cases of sickness with herbs, and a red stone purchased in the Ootacamund bazār; but serious cases are treated at the Ootacamund hospital.

The Todas scornfully deny the use of aphrodisiacs, but both men and women admit that they take *sālep misri* boiled in milk 'to make them strong.' It is stated in the 'Pharmacographia Indica' (1893) that the "*sālep* of Madras is largely supplied from the Nilgiris, where it is collected by the Todas and other hill tribes." The district forest officer of the Nilgiris writes, however, more recently that there is now little or no trade, as the digging up of the roots has been prohibited in the reserve forests.

Sālep misri, it may be mentioned, is made from the tubers (testicles de chien) of various species of *Eulophia* and *Orchis*, belonging to the natural order *Orchideæ*.

When a Toda meets a Badaga he bends down, and the
 Relations with other tribes. Badaga, as a form of greeting and sign of superiority, places his hand on the top of the Toda's head. The Todas believe that their tribe has always dwelt on the Nilgiris, and that the other tribes came up from the plains. When the Badagas arrived on the hills, they put under cultivation land which previously belonged to the Todas (who claim to have originally owned the whole of the Nilgiris). As 'compensation allowance,' the Badagas give grain of various kinds (*gudu*) to the Todas in proportion to the abundance of the crop, only objecting, it is said, to do so when the crop is short. But there is reason to believe that the Badaga is not inclined to give as freely at the present day as in times gone by, and the Toda is commencing to be thrown on his own resources as a means of gaining the equivalent of his daily bread.

Some years ago a Toda was found dead, in a sitting posture, on the top of a hill near a Badaga village, to which a party of Todas had gone to collect the tribute. The body was burned, and a report then made to the police that the man had been murdered. On enquiry it was ascertained that the dead man was supposed to have bewitched a little Badaga girl, who died in consequence; and the presumption was that he had been murdered by the Badagas out of revenge.

When a Toda meets a Kota, the latter kneels and raises the feet of the Toda to his head. From the Kotas the Todas acquire their iron implements (axes, *māmutis*, knives, &c.) and earthenware utensils. No payment in money is made, but, when a buffalo dies, the Kotas, who are eaters of carrion, are rewarded with the flesh, hide and horns. The Kotas supply the band at Toda *tamāshas*, *e.g.*, green and dry funerals; the musicians being paid in buffaloes and rice.

When a Toda meets a Kurumbar, the latter bends forward, and the Toda places his hand on the Kurumbar's head. The Todas and Kurumbars are not on good terms, and the Todas are afraid of them, because they are believed to be sorcerers, and to possess the power of casting the evil eye on them, and making them fall sick or die. My Todaguide—a stalwart representative of his tribe—expressed fear of walking alone from Ootacamund to Kotagiri, a distance of eighteen miles along a good road, lest he should come to grief at the hands of Kurumbars; but this was, as the sequel showed, a frivolous excuse to get out of accompanying me to a distance from his domestic hearth. The Kurumbars, when they come up to the plateau to get grain from the Badagas, apparently levy black mail on the Todas, and, if they demand money or buffaloes, the Todas dare not refuse to disgorge.

A Toda meeting an Irula is saluted in the same way as by a Kurumbar; but, so far as I can gather, there is but little communication between the Todas and Irulas.

The tenure under which lands are held by the Todas is summed up as follows by Mr. R. S. Benson in his report on the revenue settlement of the Nilgiris, 1885. “The earliest settlers, and notably Mr. Sullivan, strongly advocated the claim of the Todas to the absolute proprietary right to the plateau; but another school, led by Mr. Lushington, as strongly combated these views, and apparently regarded the Todas as merely occupiers under the ryotwari system in force



TODA MAND.

generally in the presidency. From the earliest times the Todas have received from the cultivating Badagas an offering, or tribute, called '*gudu*,' or basket of grain, partly in compensation for the land taken up by the latter for cultivation, and so rendered unfit for grazing purposes, but chiefly as an offering to secure the favour, or avert the displeasure, of the Todas, who, like the Kurumbas, are believed by the Badagas, to have necromantic powers over their healths and that of their herds. The European settlers also bought land in Ootacamund from them, and to this day the Government pays them the sum of Rs. 150 per annum, as compensation for interference with the enjoyment of their pastoral rights in and about Ootacamund. Their position was, however, always a matter of dispute, until it was finally laid down in the despatch of the Court of Directors, dated 21st January, 1843. It was then decided that the Todas possessed nothing more than a prescriptive right to enjoy the privilege of pasturing their herds, on payment of a small tax, on the State lands. The Court desired that they should be secured from interference by settlers in the enjoyment of their munds (or village sites), and of their spots appropriated to religious rights. Accordingly pattas were issued, granting to each mand three bullahs (11·46 acres) of land. In 1863 Mr. Grant obtained permission to make a fresh allotment of nine bullahs (34·38 acres) to each mund on the express condition that the land should be used for pasturage only, and that no right to sell the land or the wood on it should be thereby conveyed. It may be added that the so-called Toda lands are now regarded as the inalienable common property of the Toda community, and unauthorized alienation is checked by the imposition of a penal rate of assessment (G.O., 18th April, 1882). Up to the date of this order, however, alienations by sale or lease were of frequent occurrence. It remains to be seen whether the present orders and subordinate staff will be more adequate than those that went before to check the practices referred to."

With the view of protecting the Toda lands, Government took up the management of these lands in 1893, and framed rules under the Forest Act for their management, the rights of the Todas over them being in no way affected by the rules, of which the following is an abstract :—

1. No person shall fell, girdle, mark, lop, uproot, or burn or strip off the bark or leaves from, or otherwise damage any tree growing on the said lands, or remove the timber,

or collect the natural produce of such trees or lands, or quarry or collect stone, lime, gravel, earth or manure upon such lands, or break up such lands for cultivation, or erect buildings of any description or cattle kraals; and no person or persons, other than the Todas named in the patta concerned, shall graze cattle, sheep, or goats upon such lands, unless he is authorised so to do by the Collector of the Nilgiris, or some person empowered by him.

2. The Collector may select any of the said lands to be placed under special fire protection.

3. No person shall hunt, beat for game, or shoot in such lands without a license from the Collector.

4. No person shall at any time set nets, traps, or snares for game on such lands.

5. All Todas in the Nilgiri district shall, in respect of their own patta lands, be exempt from the operation of the above rules, and shall be at liberty to graze their own buffaloes, to remove fuel and grass for their domestic requirements, and to collect honey or wax upon such lands. They shall likewise be entitled to, and shall receive free permits for building or repairing their munds and temples.

6. The Collector shall have power to issue annual permits for the cultivation of grass land only in Toda pattas by Todas themselves, free of charge, or otherwise as Government may, from time to time, direct; but no Toda shall be at liberty to permit any person, except a Toda, to cultivate, or assist in the cultivation, of such lands.



KOTA MAN.

II.—THE KOTAS OF THE NILGIRIS.

ACCORDING to Dr. Oppert "it seems probable that the Todas and Kotas lived near each other before the settlement of the latter on the Nilagiri. Their dialects betray a great resemblance. According to a tradition of theirs (the Kotas), they lived formerly on Kollimallai, a mountain in Mysore. It is wrong to connect the name of the Kotas with cow slaying, and to derive it from the Sanskrit *gō-hatyā* (cow-killer). The derivation of the term Kota is, as clearly indicated, from the Gauda-Dravidian word *ko* (*ku*), mountain, and the Kotas belong to the Gaudian branch."

The Kotas were returned at the census of 1891 as numbering 1,201 (556 males and 645 females) against 1,062 (498 males and 564 females) in 1881. They inhabit seven villages, of which six—Kotagiri (or Peranganād), Kīl-Kotagiri, Todanād, Mekanād, Kundanād, and Sholur—are situated on the plateau, and one is at Gudalur in the Wynād, on the northern slopes of the Nilgiris. They form large communities, and each village consists of thirty to sixty or more detached huts and rows of huts arranged in streets. The huts are built of mud, brick, or stone, roofed with thatch or tiles, and divided into living and sleeping apartments. The floor is raised above the ground, and there is a verandah in front with a seat on each side, whereon the Kota loves to take his siesta, and smoke his cheroot in the shade, or sleep off the effects of a drinking bout. The door-posts of some of the huts are ornamented with carving executed by wood carvers in the plains. A few of the huts and one of the forges at Kotagiri have stone pillars sculptured with fishes, lotuses, and floral embellishments by stone carvers from the plains.

The Kotas have no caste, but are divided into *kēris* or streets, viz., *kīlkēri*, *mēlkēri*, and *nadukēri*. People belonging to the same *kēri* may not intermarry, as they are supposed to belong to the same family, and intermarriage would be distasteful. The following examples of marriage between members of different *kēris* were recorded in my notes :—

Husband.

Kilkēri.

Do.

Do.

Nadukēri.

Mēlkēri.

Nadukēri.

Wife.

Nadukēri.

Do.

Mēlkēri.

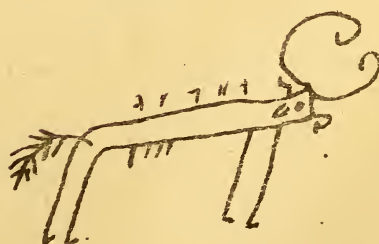
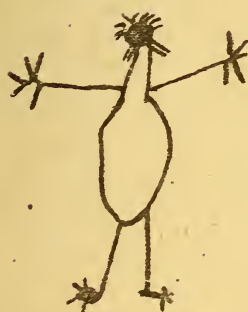
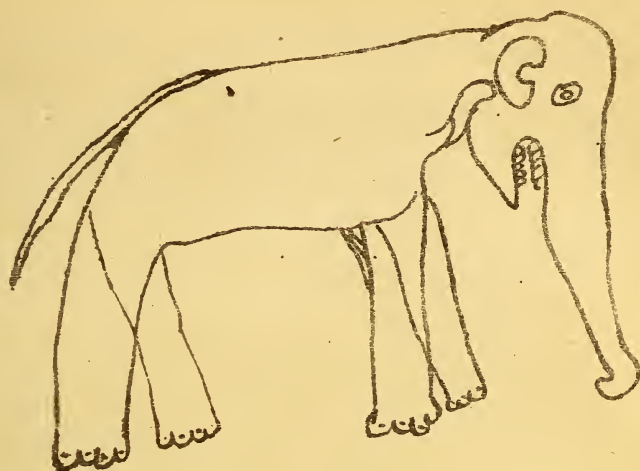
Do.

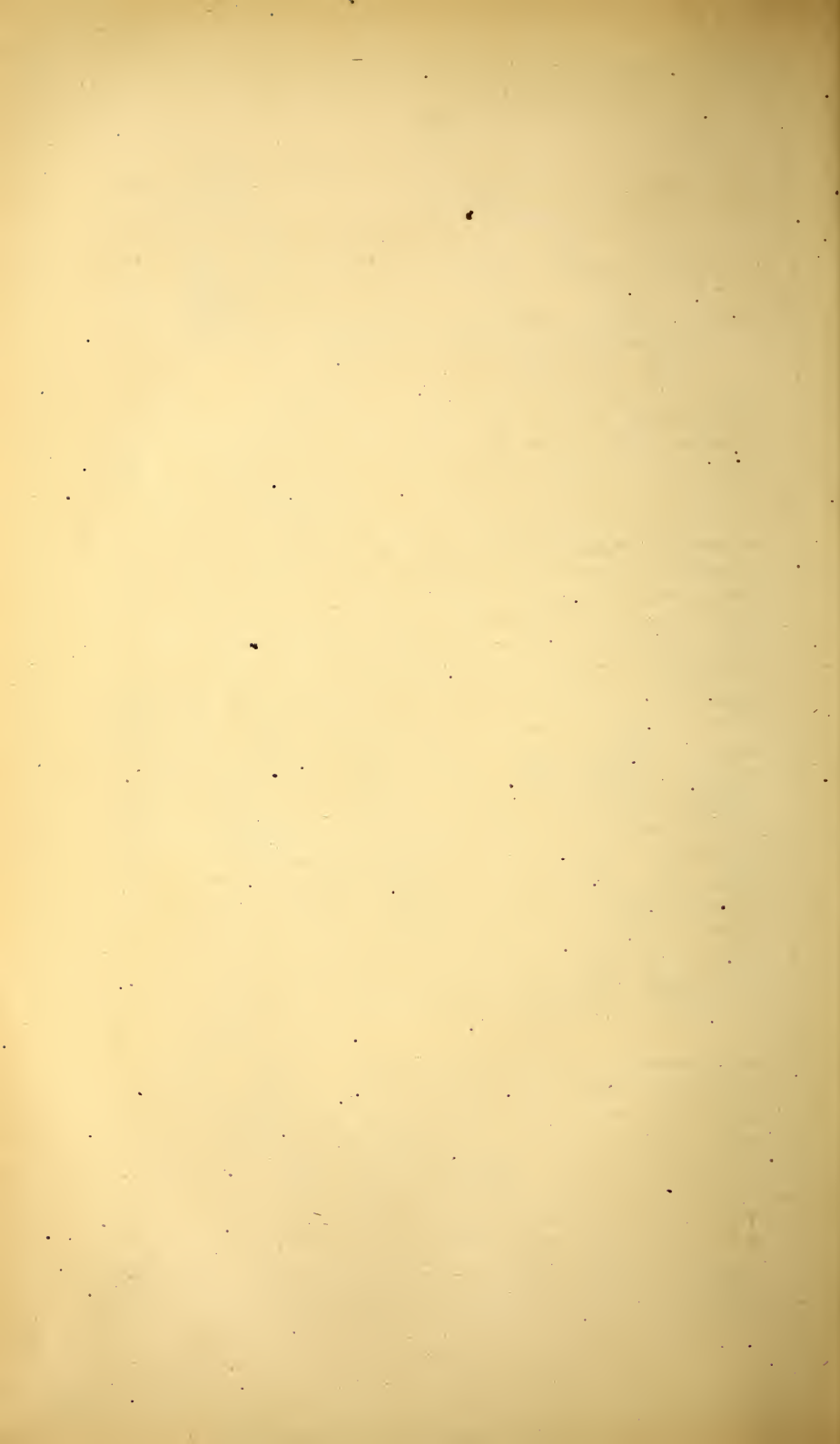
Nadukēri.

First wife Kilkēri, second
wife Mēlkēri.

On the day following my arrival at Kotagiri on the eastern extremity of the Nilgiri plateau, a deputation of Kotas from the neighbouring village waited on me, and, having learnt that I was a Government official, consented to allow me to record their measurements only on the distinct understanding that I would not get their land-assessment increased—a point on which they were unnecessarily suspicious of me. For a few days all went well; measurements were taken, and photographs duly admired. But the Kotas did not, like the Todas, enter good-humouredly into the spirit of an anthropological inquiry. A sudden strike set in, and an order was circulated among the village community that the measurement of women was not to be continued. The crisis was, however, after much argument and many interviews with leading representatives of the tribe, headed by an overfed monegar (head-man), who receives a small salary from Government to collect rent and make returns of vital statistics, overcome by the intervention of the local Tahsildar (revenue officer). As a sign that peace was declared, three ancient and shrivelled female hags turned up at the bungalow to be measured. Subsequently, however, yet another strike ensued, and I was unblushingly informed that all the women were *enceinte* and could not leave the village, though I met troops of them on the road every evening.

My first interview with the object of extracting information as to Kota 'manners and customs' (to use a time-honoured phrase) was not a conspicuous success; the man who was engaged to act as my informant arriving in a state of maudling intoxication, and dressed up in the cast-off clothes of a British soldier. However, an excellent substitute was found in an intelligent and well-to-do blacksmith, who, in return for a print of his photograph, cheroots, a new cloth, and money wherewith to purchase drink, became a faithful ally. To the pencil of this man is due the drawing of an elephant reproduced on plate xxii for comparison





with the more crude efforts of a Toda lad to depict a man, a buffalo, and an elephant.

The besetting vice of the Kotas is a partiality for drink, and they congregate towards evening in the arrack shop and beer tavern in the bazár, whence they stagger or are helped home in a state of noisy and turbulent intoxication.

The Kotas are universally looked down on as being unclean feeders and eaters of carrion; a custom which is to them no more filthy than is that of eating game when it is high, or using the same tooth-brush day after day to a European. An unappetising sight, which may frequently be witnessed on roads leading to a Kota village, is that of a Kota carrying the flesh of a dead buffalo, often in a high state of putridity, slung on a stick across his shoulders, with the entrails trailing on the ground, so that "the very scent of the carrion—faugh—reached my nostrils at the distance where we stood." Colonel Ross King narrates¹⁷ how he once saw a Kota carrying home for food a dead rat thrown out of the stable a day or two previously. When I repeated this story to my informant, he glared at me, and bluntly remarked (in Tamil) "The book tells lies." Despite its unpleasant nature, the carrion diet evidently agrees with the Kotas, who are a hard, sturdy set of men, flourishing, it is said, most exceedingly when the hill-cattle are dying of epidemic disease, and the food-supply is consequently abundant.

Though all classes look down on the Kotas, all are agreed that they are excellent artisans, whose services as blacksmiths, carpenters, rope and umbrella makers, etc., are indispensable to the other hill tribes. In fact the Todas believe that the Kotas are a caste of artisans specially brought up from the plains to work for them. Each Toda, Irula, Kurumba, and Badaga settlement has its Muttu Kotas, who work for the inhabitants thereof, and supply them with sundry articles called muttu in return for the carcasses of buffaloes and cattle, ney (clarified butter), grain, and plantains. The Kotas eat the flesh of the buffaloes and cattle which they receive, and sell the horns to Labbi (Muhamadan) merchants from the plains. Chucklers (boot-makers) from the plains collect the bones (which the Kotas might utilise as a source of income), and purchase the hides, which are roughly cured by the Kotas with chunám.

¹⁷ *Op. cit.*

(lime) and ávaram bark (*Cassia auriculata*), and fastened to the ground with pegs to dry.

The Kota blacksmiths, who are skilled workmen, make hatchets, bill-hooks, knives, and other implements for the various hill tribes, especially the Badagas, and at times for 'Hindus' and Europeans. Within the memory of men still living they used to work with iron-ore brought up from the plains, but now depend on scrap-iron which they purchase locally in the bazár. The most flourishing smithy in the Kotagiri village is made of brick, of local manufacture, roofed with zinc, and fitted with appliances (anvil, pincers, &c.), of European manufacture.

As agriculturists the Kotas are said to be quite on a par with the Badagas, and they raise on the land adjacent to their villages extensive crops of potatoes, bearded wheat, kírai (amaranth), sâmai (*Panicum miliare*), koráli (*Setaria italica*), mustard, onions, &c.

At the revenue settlement, 1885, the Kotas were treated in the same way as the Badagas and other tribes of the Nilgiris, except the Todas, and the lands in their occupation were assigned to them at rates varying from 10 to 2 annas per acre. The 'bhurty' or shifting system of cultivation, under which the Kotas held their lands, was formally, but nominally, abolished in 1862-64; but it was practically and finally done away with at the revenue settlement of the Nilgiri plateau. The Kota lands are now held on puttass under the ordinary ryotwari tenure.

In former days opium of good quality was cultivated by the Badagas, from whom the Kotas got poppy-heads, which their herbalist practitioners used for medicinal purposes. Now-a-days, however, the Kotas purchase opium in the bazár, and use it as an intoxicant.

The Kota women have none of the fearlessness and friendliness of the Toda, and, on the approach of a European to their domain, bolt out of sight, like frightened rabbits in a warren, and hide within the inmost recesses of their huts. As a rule they are clad in filthily dirty cloths, all tattered and torn, and frequently not reaching nearly as low as the knees. In addition to domestic duties, the women have to do work in the fields, fetch water, and collect fire-wood, with loads of which, supported on the head by a pad of bracken fern leaves, and bill-hook slung on the shoulder, old and young women, girls and boys, may continually be seen returning to the village. The women also make baskets, and rude earthen pots on a



KOTA WOMAN.

potter's wheel. This consists of a disc made of dried mud, with an iron spike, by means of which it is made to revolve in a socket in a stone fixed in the ground in the space in front of the houses, which also acts as a winnowing floor.

Education, in its most elementary form, cannot be said to have taken a keen grip of the Kotas; for, though a night-school has been established in their village at Kotagiri by the Basel Mission for the last eight years, at the time of my visit to Kotagiri only nine males, of various ages from twelve to twenty-four, out of a community of several hundreds, were on the school books.

The chief characteristics of the Kotas, their personal ornaments, system of tattooing, &c., will be gathered from the following illustrative cases.

As a type of a Kota man the following case may be cited:—

No. 1. Male, aged 25. Name Komuttan. Blacksmith and carpenter. Silver bangle on right wrist; two silver rings on right little finger; silver ring on each first toe. Gold ear-rings. Langūti tied to silver chain round loins.

Height 164·4 cm.

Weight 125 lbs.

Skin of exposed parts rather darker than protected parts. (Unexposed parts, especially the chest, are in some Kotas markedly pale by contrast.)

Hair of head black, wavy, parted in middle, and tied in a bunch behind. Imperial moustache, waxed. Beard trimmed short. Hair well developed on chest, abdomen, extensor surface of forearms, and legs. Hair of axillæ shaved, as being an eye-sore. (The Kotas are not nearly such a hairy race as the Todas, but, as in Europeans, Brāhmans, etc., individuals are frequently met with, in whom the hairy system is well developed on the trunk and extremities.)

Forehead narrow and prominent. Countenance indicates decision of character. Length from vertex to chin 21·1 cm. Bizygomatic 12·7. Bigoniac 9·6 cm. Glabella and superciliary ridges not marked. Eyebrows bushy, united across middle line by thick hairs. Cheek-bones rather prominent. Lips thin. Facial angle (of Cuvier) 70°. Teeth white, and well formed. (The teeth of the Kotas are often discoloured from the habit of chewing betel.)

Eyes horizontal. Iris dark-brown.

Nose straight, narrow. Height 4·6 cm.; breadth 3·2 cm. Alæ expanded.

Ears not outstanding, shallow. Height 5·6 cm. Lobules not attached, pierced.

Cephalic length 19·1 cm.; breadth 14·2 cm.

Chest 83 cm. circumference.

Shoulders 38 cm.

Biceps 28·5 cm. circumference.

Cubit 45·6 cm.

Hand, length, 18·5 cm.; breadth 8·4 cm.

Thigh 45 cm. circumference.

Calf 32 cm. circumference.

Foot, length, 25·8 cm.; max: breadth 8·9 cm.

The average height of the Kota man, according to my measurements, is 162·9 cm.; but the following is an example of the tallest Kota whom I saw, and who considerably exceeds the mean.

No. 2. Male, aged 35. Carpenter. Light blue eyes inherited from his mother. His children have eyes of the same colour. Lobules of ears pendulous from heavy gold ear-rings set with pearls. Black hair on head and beard. Black, mixed with brown hairs, beneath lower lip, and in moustache. Nose aquiline. (Another Kota man with light blue eyes was also noticed by me.)

	Man No. 2.	Kota average.
Weight	130 lbs.	115 lbs.
Height	178·3 cm.	162·9 cm.
Do. sitting	90·4 "	85·8 "
Do. kneeling	121·4 "	120 "
Do. to gladiolus	131·6 "	120·6 "
Span of arms	190·2 "	168·3 "
Chest	86 "	83·3 "
Shoulders	40 "	37·7 "
Cubit	49·5 "	45·1 "
Hand, length	19·6 "	18 "
Do. breadth	8·7 "	8 "
Hips	28·5 "	27 "
Foot, length	26·7 "	25·2 "
Do. breadth	9·7 "	8·8 "

No. 3. Male. An old man, bearing a certificate from the Duke of Buckingham appointing him head-man of the Kota at Kotagiri, in recognition of his services and good character.



KOTA NAUTCH PARTY.

Says that he is sixty-five years old, but looks, and must be, many years older, as he appears as an elderly white-haired man in a photograph taken by Mr. Breeks more than twenty years ago. Bowed with age, and walks with support of a stick. (The Kotas, unlike the Todas, do not as a rule carry walking-sticks.) Bald over frontal and temporal regions. White hair on head and face, and long white hairs in middle of chest.

No. 4. Boy, aged 13. Height 145·4 cm. Shock head of hair, which is being permitted to grow where it was till recently shaved. Long tuft of hair hanging down from vertex below neck behind. Incipient moustache. Hair developed in axillæ, not on trunk. Bushy eyebrows united by dense hairs. Iris light brown. Silver bangle on right wrist; two silver rings on left first finger.

No. 5. Boy, aged 10-12. Hair shaved on top, sides, and back of head, leaving a tuft of long hair hanging down from vertex behind *à la* Hindu. Ears pierced. Forehead very prominent and narrow. Cephalic length 18·5 cm.; breadth 13·9 cm.

No. 6. Man. Hair tied behind in a bunch by means of a string with a silver ring attached to it.

No. 7. Man. Two letters of his name tattooed (blue) on front of left forearm.

No. 8. Man. Initial letter of his name tattooed (blue) on front of left forearm.

No. 9. Man. Branded with cicatrix of burn made, when a young man, with a burning cloth, across lower end of back of forearm. This is a distinguishing mark of the Kotas, and is made on boys when they are more than eight years old.

No. 10. Man. 'Grog-blossom' nose. Breadth of nose 4·6 cm. He is a confirmed drunkard, but attributes the inordinate size of his nasal organ to the acrid juice of a tree which he was felling dropping on to it.

No. 11. Woman, aged 30. Divorced for being a confirmed opium-eater, and living with her father. Dull, muddy complexion. Vacant expression of countenance. Skin of chest pale by contrast with the neck. Hair of head smooth, parted in middle, and done up behind in bunch round pad of leaves. Bushy eyebrows united across middle line by hairs. Slight moustache. Wears a dirty cotton cloth with blue and red stripes, covering body and reaching below knees, and a

plain cotton loin-cloth. Two brass and glass bead necklets. Four copper rings on left upper arm above elbow. Two copper bangles separated by cloth ring on right wrist; two brass bangles separated by similar ring on left wrist. Brass ring on first toe of each foot. Blue tattooed line uniting eyebrows. Name in Tamil tattooed on right forearm. Two vertical tattooed lines on left upper arm. Tattooed with rings and lines on outer side of right upper arm (pl. xxvi, 1).

Height 146.6 cm.

Weight 86 lbs.

Shoulders 33.8 cm.

Cubit 40.9 cm.

Hand, length, 16.5 cm.; breadth 7.1 cm. Nails kept long for combing hair.

Foot, length, 22 cm.; max : breadth 7.7 cm.

Cephalic length, 18.2 cm.

„ breadth, 13.7 cm.

Forehead prominent. Bigoniac 9.4 cm. Bizygomatic 12.4 cm. Facial angle 68°. Teeth white and regular.

Nose, snub. Height 4.1 cm.; breadth 3.3 cm.

Ears pierced. Too poor to afford ear-rings.

12. Woman, aged 40. Two plain glass-bead necklets, and bead necklet ornamented with silver rings. Four brass rings and one steel ring on left forearm. Two massive brass bangles, weighing two pounds each, and separated by cloth ring, on right wrist. Brass bangle with brass and steel pendants, and shell bangle on left wrist. Two steel and one copper ring on right ring finger; brass rings on left first, ring, and little fingers. Two brass rings on first toe of each foot. Tattooed line uniting eyebrows. Tattooed on outer side of both upper arms with rings, dots, and lines (pl. xxvi, 2); rows of dots on back of right forearm; circle on back of each wrist; rows of dots on left ankle.

13. Woman, aged 35. Tattoo marks on forearms (pl. xxvi, 3 and 4).

14. Woman, aged 35. Tattoo marks on right upper arm (pl. xxvi, 5).

15. Woman, aged 25. Tattoo marks on right upper arm (pl. xxvi, 6) and left forearm (pl. xxvi, 7).

16. Woman, aged 25. Tattoo marks on right upper arm (pl. xxvi, 8) and left forearm (pl. xxvi, 9).

17. Woman, aged 35. Glass necklet ornamented with cowry shells, and charm pendent from it, consisting of a



KOTA WOMEN.

fragment of the root of some tree rolled up in a ball of cloth. She put it on when her baby was about a month old, to protect it against devils. The baby has a similar kind of charm round the neck.

18. Woman, aged 30. Has been treated in hospital for syphilitic ulceration of the palate. History of primary syphilis.

The Kota priesthood is represented by *dēvādis* and *pūjāris*, who wear no distinguishing dress. The office of *dēvādi* is carried on by heredity, and the *pūjāris* are appointed by the *dēvādi* when under the influence of inspiration by the *swāmi* (god). The *dēvādi* becomes at times possessed by the god, to whom he repeats the requests and desires of the people, and delivers to them the answer of the god. He is permitted to live with his wife, and not bound, like the *Toda pālāl*, to a celibate existence. On the death of a *dēvādi*, the god takes possession of some member of his family, who dreams that the mantle of the dead priest has descended on him, and becomes seized with inspiration in the temple.

In addition to the *dēvādi*, each village has two *pūjāris*, appointed by the *dēvādi* when under the influence of inspiration by the god. Their main duty is to perform *pujas* in the temple.

They too may be married, and live with their wives; but, at the great festival in honour of *Kāmatarāya*, neither *dēvādi* nor *pūjāri* may live or hold communion with their wives for fear of pollution, and they have to cook their meals themselves.

"Some rude image of wood or stone, a rock or tree in a secluded locality, frequently form the Kota's object of worship, and to which sacrificial offerings are made; but the recognised place of worship in each village consists of a large square piece of ground, walled round with loose stones, three feet high, and containing in its centre two¹⁸ pent-shaped sheds of thatch, open before and behind, and on the posts (of stone) that support them some rude circles and other figures are drawn. No image of any sort is visible here" (Shortt). These sheds, which are a short distance apart, are dedicated to *Siva* and his consort *Pārvatī* under the names of *Kāmatarāya* and *Kālikai*. Though

¹⁸ At Kolamalé there are three temples, two dedicated to *Kāmatarāya* and one to *Kālikai*.

no representation of the swāmis is exhibited in the temples at ordinary times, their spirits are believed to pervade the buildings, and at the annual ceremony they are represented by two thin, plain plates of silver, which are attached to the upright posts of the temples. The stones surrounding the temples at Kotagiri are scratched with various quaint devices, and lines for the games of hulikotē and kotē.

The Kota villagers go, I was told, to the temple once a month, at full moon, and meditate on and worship god. Their belief is that Kāmatarāya created the Kotas, Todas, and Kurumbas, but not the Irulas. "Tradition says of Kāmatarāya that, perspiring profusely, he wiped from his forehead three drops of perspiration, and out of them formed the three most ancient of the hill tribes—the Todas, Kurumbas and Kotas. The Todas were told to live principally upon milk, the Kurumbas were permitted to eat the flesh of buffalo calves, and the Kotas were allowed perfect liberty in the choice of food, being informed that they might eat carrion if they could get nothing better." (Breeks.)

In comparatively recent years the Kotas have created a new god, named Māgāli, to whose influence outbreaks of cholera are supposed to be due; and a goddess, named Māriammā, is supposed by the Kotas to be responsible for small-pox. When cholera breaks out among the Kota community, special sacrifices are performed with a view to propitiating the wrath of the god. Māgāli is represented by an upright stone in a rude temple at a little distance from Kotagiri, where an annual ceremony is held, at which some man will become possessed, and announce to the people that Māgāli has come. At this ceremony a special priest (pūjāri) offers up plantains and cocoanuts, and makes a sacrifice of sheep and fowls. My informant, despite the fact that he was the pūjāri of Māgāli, was, or pretended to be, ignorant of the following legend recorded by Breeks as to the origin of the worship of the god of small-pox. "A virulent disease carried off a number of Kotas of Peranganāda, and the village was abandoned by the survivors. A Badaga named Munda Jogi, who was bringing his tools to the Kotagiri to be sharpened, saw near a tree something in the form of a tiger, which spoke to him, and told him to summon the run-away Kotas. He obeyed, whereupon the tiger form addressed the Kotas in an unknown tongue, and vanished. For some time the purport of this communication remained a mystery. At last, however, a Kota came forward to interpret, and declared that the god ordered

the Kotas to return to the village on pain of a recurrence of the pestilence. The command was obeyed, and a swāmi house was built on the spot where the form appeared to the Badaga (who doubtless felt keenly the inconvenience of having no Kotas at hand to sharpen his tools)."

In a Report by Lieutenant Evans, written in 1820, it is

Sexual.

stated that "the marriages of this caste (the Kothewars) remind one of what is called bundling in Wales. The bride and bridegroom being together for the night, in the morning the bride is questioned by her relatives whether she is pleased with her husband elect. If she answers in the affirmative, it is a marriage; if not, the bridegroom is immediately discharged, and the lady does not suffer in reputation if she thus discards half a dozen suitors." The recital of this account, translated into Tamil, raised a smile on the face of my Kota informant, who volunteered the following information relating to the betrothal and marriages ceremonies of the present day.

Girls, as a rule, marry when they are from twelve to sixteen years old, between which years they reach the age of puberty. A wife is selected for a lad by his parents, subject to the consent of the girl's parents; or, if a lad has no near relatives, the selection is made for him by the villagers. Betrothal takes place when the girl is quite a child (eight to ten). The boy goes, accompanied by his father and mother, to the house where the girl lives, prostrates himself at the feet of her parents, and, if he is accepted, presents his future father-in-law with a four-anna piece, which is understood to represent a larger sum. According to Breeks the boy also makes a present of a bīrianhana of gold, and the betrothal ceremony is called bali-med-deni (bali, bracelet; med-deni, I have made). Both betrothal and marriage ceremonies take place on Tuesday, Wednesday, or Friday, which are regarded as auspicious days.

The ceremonial in connection with marriage is of a very simple nature. The bridegroom elect, accompanied by his relatives, attends a feast at the house of his bride, and the wedding day is fixed. On the appointed day the bridegroom pays a dowry, varying from ten to fifty rupees, to his bride's father, and takes the girl to his house, where the wedding guests, who have accompanied them, are feasted.

The Kotas seem to be prolific, and families of eight, nine, ten or more are not uncommon; but it is rarely that the

whole of a large family grows up, many dying in infancy. Widow remarriage is permitted.

The Kotas, as a rule, have only one wife, and polyandry is unknown among them. But in some instances polygamy is practised. My informant, for example, had two wives, of whom the first had only presented him with one child, a daughter; and, as he was anxious to have a son, he had taken to himself a second wife. If a woman bears no children, her husband may marry a second, or even a third wife; and, if they can get on together without fighting, all the wives may live under the same roof; otherwise they occupy separate huts.

Divorce may, I was told, be obtained for incompatibility of temper, drunkenness, or immorality; or a man can get rid of his wife 'if she is of no use to him,' *i.e.*, if she does not feed him well, or assist him in the cultivation of his land. Divorce is decided by a pāṇchāyat (council) of representative villagers, and judgment given, after hearing the evidence, by an elderly member of the community. Cases of theft, assault, or other mild offence are also settled by a pāṇchāyat, and, in the event of a case arising which cannot be settled by members of council representing a single village, delegates from all the seven villages meet together. If even then a decision cannot be arrived at, recourse is had to the official court, of which the Kotas steer clear if possible. At a big pāṇchāyat the head-man (pittakār) of the Kotas gives the decision, referring, if necessary, to some 'sensible member' of the council for a second opinion.

When a married woman is known to be pregnant with her first child, her husband allows the hair of the head and face to grow long, and leaves the nails of both hands uncut. At the time of delivery the woman is removed to a hut (a permanent structure) called vollūgūdi (vollū inside, gūdi nest), which is divided into two rooms, one of which serves as a lying-in hospital, the other for women at the menstrual periods. Women are attended in child-birth by a professional Kota midwife, who is remunerated with board and a new cloth. After the birth of the child the woman apparently remains in the vollūgūdi till the next full moon, and then goes for a further space of two months to another hut called tēlulu. On departure from the vollūgūdi the baby is fed with rice boiled, in a specially made clay pot, on a fire made with the wood of a particular jungle tree. When the woman leaves the tēlulu, a feast is given to the relatives, and the head-man of the khēri gives the child a name which has been



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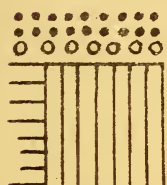
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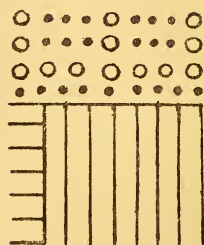
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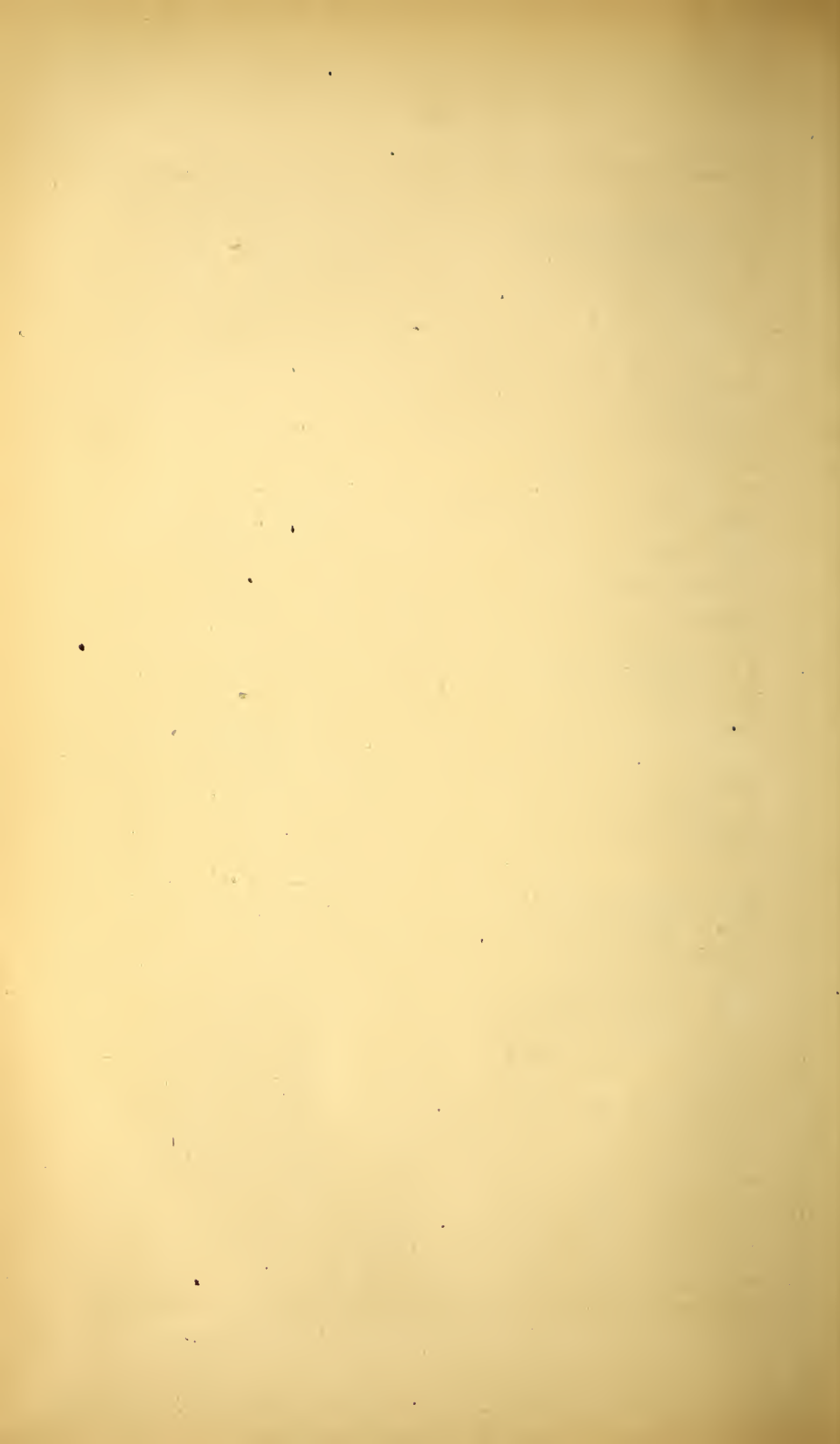
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chosen by its father. Before the woman returns to her home, at the end of her temporary banishment therefrom, it is purified with cow-dung and water, and, as she enters her house, the man who has named the child gives her a few drops of water to drink. Breeks mentions that a woman with her first child, on leaving the vollügüdi for the tēlulu, must make seven steps backwards among seven kinds of thorns strewed on the ground; but my informant expressed ignorance of any such ceremony.

A common name for females is Mādi, one of the names of the goddess Kālikai; and the first male child is always called Komuttan (= Kāmatarāya). The numerous Komuttans in a village are distinguished by the prefix big, little, carpenter, etc.

When a man or woman is on the point of death, a gold coin (virāya fanam) is placed in the mouth. After death the corpse is laid out on a mat, covered with a cloth, the thumbs are tied together with string, and the hands placed on the chest. The relatives of the deceased, the pūjari and dēvādi, and Kotas of other villages who have been informed of the death, come and salute the corpse, head to head, and mourn over it.

A rude catafalque (tēru), made of wood and decorated with cloths, is placed in front of the house of the deceased, round which the Kotas dance to the strains of a Kota band, while the near relatives continue mourning. A male buffalo is fetched from a Badaga village or Toda mand, and killed outside the village, as at a Toda kēdu, from which some of the Kota funeral rites are borrowed. The carcase is skinned, cut up, and taken to the house where the corpse is lying. Half the flesh is distributed among the Kota villagers.

When the time of the funeral has arrived, the dead body is removed from the house, placed on a stretcher, and taken outside the village, with the catafalque borne in front, to a tree in the jungle. A cow (not buffalo) is then killed, the hand of the corpse placed on one of the horns, and all present salute it with the same ceremonial as at a Toda green funeral. The dead cow is handed over to pariahs, and not eaten by Kotas. From the jungle the corpse and catafalque are carried to the burning ground, where a funeral pyre is made, on which the corpse is laid face upwards, and burned beneath the catafalque. If the corpse be that of a man, jewelry, cheroots, various kinds of grain, iron implements, walking-stick, and buguri (musical instrument);

and, if of a woman, jewelry, a winnowing basket, rice measure, rice beater, sickle, cakes and rice are burnt. The widow of a dead man is said to place on the dead body her tali (marriage badge) and other ornaments, which are, however, removed before the pyre is kindled.

On the day following that of the funeral, the smouldering ashes are extinguished with water, and the ashes, excepting the remains of the skull, collected together and buried in a pit, the site of which is marked by a heap of stones. The skull is buried separately in a spot which is also marked by a heap of stones. A feast, whereat the half of the buffalo which was not given to the villagers is served up as funeral baked meat, is then held.

In the month of December a dry funeral ceremony takes place, in imitation of the Toda bara kēdu. Eight days before the date fixed for the ceremony, a dance takes place in front of the houses of the Kotas whose memorial rites are to be celebrated, and three days before their celebration invitations are issued to the different Kota villages. On the appointed day the relatives of the deceased have buffaloes ready, and place the skulls, which have been unburied, wrapt in cloths, on a cot. Obeisance is made to the relics by touching them with the head. They are then carried to a shola (the funeral ground), where the buffaloes—one for each skull—decorated with a bell hung round the neck, are killed. The skulls are then burned with the same articles as at the burning of the corpse, with, in the case of a male, the addition of a pole (tarzh), twenty feet long, decorated with cowries, such as is burned at Toda dry funerals. The burning concluded, water is poured from a chatty over the ashes, on which no further care is bestowed. Those who have been present at the ceremony remain all night on the spot, where, on the following morning, a feast and dance take place. Finally a dance is held in the village; the dancers being dressed up as at the annual feast.

It may be noted that if a child only a few days old dies, the body is buried instead of being burnt.

A great annual festival is held in honour of Kāmatarāya with the ostensible object of propitiating him with a view to his giving the Kotas an abundant harvest and general prosperity. The feast commences on the first Monday after the January new moon, and lasts for about a fortnight, which is observed as a general holiday, and is said to be a continuous scene of licentiousness and debauchery, much indecent dancing

taking place between men and women. According to Metz, the chief men among the Badagas must attend the festival; otherwise their absence would be regarded as a breach of friendship and etiquette, and the Kotas would immediately avenge themselves by refusing to make any ploughs or earthen vessels for the Badagas.

The programme of events, so far as I have been able to gather without being present as an eye-witness, is somewhat as follows :—

A fire is kindled by one of the priests in the temple, and carried to the Nadukēri section of the village, where it is kept burning throughout the festival. Around the fire men, women, adolescent boys and girls, dance to the weird music of the Kota band, whose instruments consist of clarionet, drum, tambourine, brass horn, and buguri (Toda flute).

Second day	} Dance at night.
Third day	
Fourth day	
Fifth day	

The villagers go to the jungle, and collect bamboos and rattans, with which to re-roof the temples. Dance at night.

Sixth day. The day is busily spent in re-roofing and decorating the temples, and it is said to be essential that the work should be concluded

Seventh day. before night-fall. Dance at night.

In the morning the villagers go to Badaga villages, and cadge for presents of grain and ghī which they subsequently cook, place in front of the temple as an offering to the swāmi, and, after the priests have eaten, partake of, seated round the temple.

Kotas, Todas, Badagas, Kurumbas, Irulas and 'Hindus' come to the Kota village, where an elaborate nautch is performed, in which men are the principal actors, dressed up in gaudy attire consisting of skirt, petticoat, trousers, turban and scarves, and freely decorated with jewelry which is either their own property or borrowed from Badagas for the occasion. Women merely dressed in clean cloths, also take part in a dance called kumi, which consists of a walk round to time beaten with the hands. I was present at a private performance of the male nautch, which was as dreary as such entertainments usually are, but it lacked the go which is doubtless put into it when it is performed under natural

conditions in the village away from the restraining influence of the European. The nautch is apparently repeated daily until the conclusion of the festival.

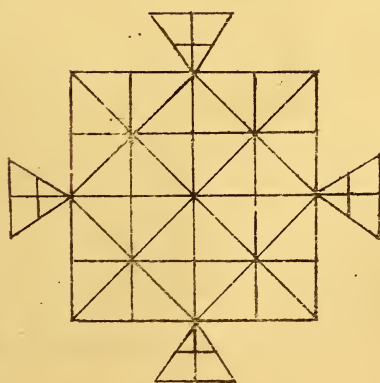
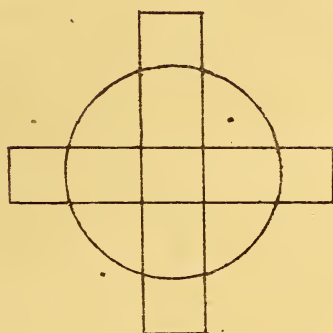
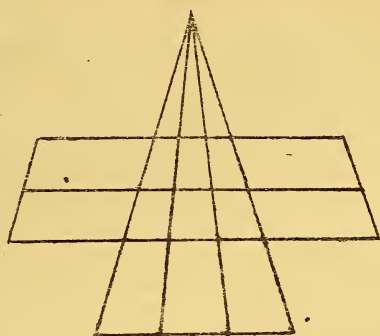
A burlesque representation of a Toda kēdu (funeral ceremony) is given, at which the part of the sacrificial buffaloes is played by men with buffalo horns fixed on the head, and body covered with a black cloth.

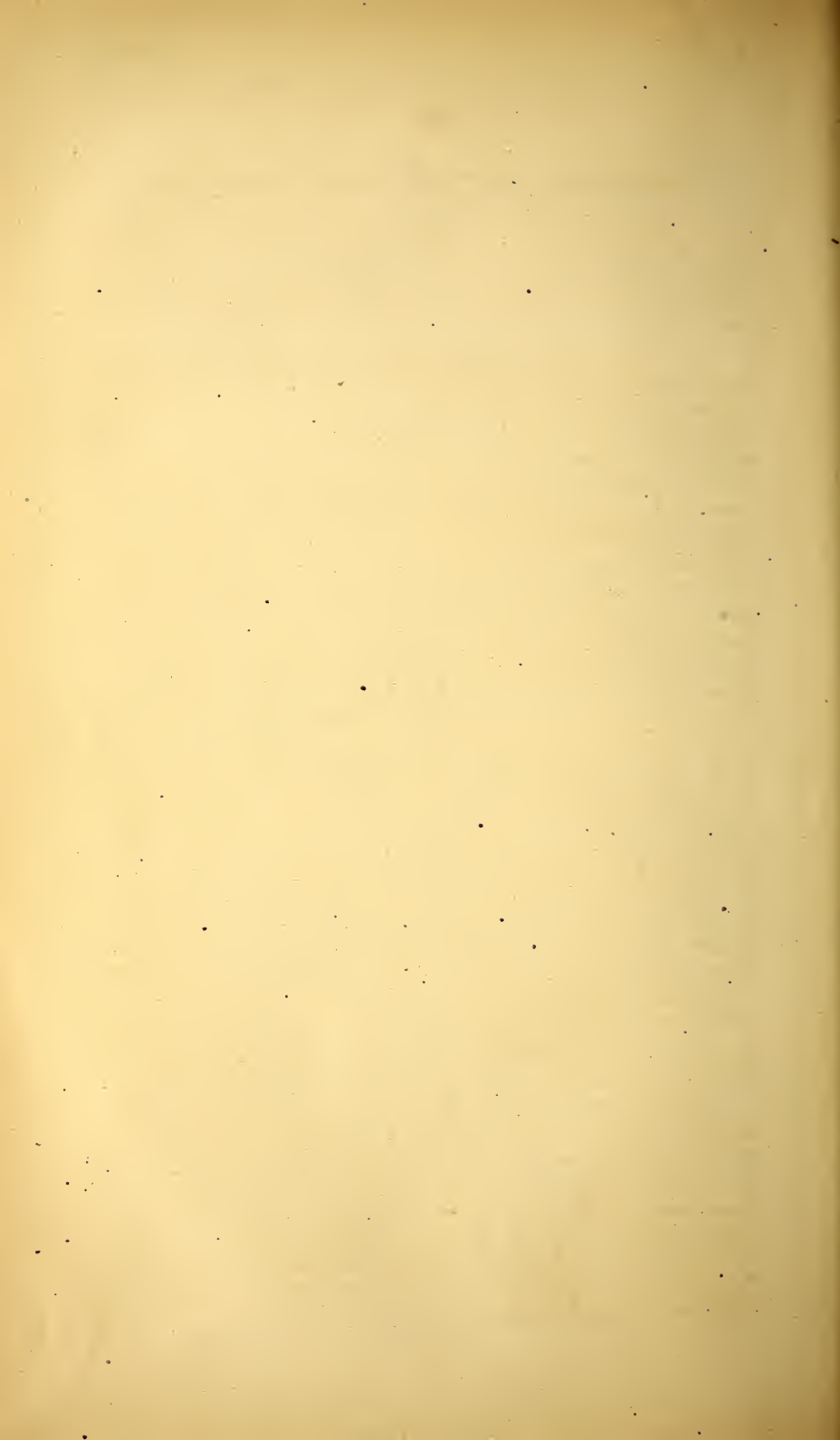
At the close of the festival the pūjāris, dēvādi, and leading Kotas go out hunting with bows and arrows, leaving the village at 1 A.M. and returning at 3 A.M. They are said to have shot bison ¹⁹ at this nocturnal expedition; but what takes place at the present day is said to be unknown to the villagers, who are forbidden to leave their houses during the absence of the hunting party. On their return to the village, a fire is lighted with a hand fire drill by friction, a twig of the baiga tree, with cloth wrapped round its point, being twisted round in a socket in a plank until it ignites. Into the fire a piece of iron is put by the dēvādi, made red-hot with the assistance of the bellows, and hammered by the pūjāri. The priests then offer up a parting prayer to the swāmi, and the festival is at an end.

Like the Todas, the Kotas indulge in trials of strength with heavy spherical stones, which they raise, or attempt to raise, from the ground to the shoulders, and in a game resembling the English tip-cat. In another game sides are chosen, of about ten on each side. One side takes shots with a ball made of cloth at a brick propped up against a wall, near which the other side stands. Each man is allowed three shots at the brick. If the brick is hit and falls over, one of the 'outside' picks up the ball, and throws it at the other side, who run away and try to avoid being hit. If the ball touches one of them, the side is put out, and the other side go in.

A game, called hulikote, which bears a resemblance to the English child's game of fox and geese, is played on a stone chiselled with lines which forms a rude playing board. In one form of the game (pl. xxvii) two tigers and twenty-five bulls, and in another form (pl. xxvii) three tigers and fifteen bulls engage, and the object is for the tigers to take, or, as the Kotas express it, kill all the bulls. In a further game, called kotē, a labyrinthiform pattern, or maze, is chiselled on a stone, to get to the centre of which is the problem.

¹⁹ *Bos gaurus*, the bison of European sportsmen.





COMPARISON BETWEEN TODAS AND KOTAS.

A comparative table of measurements of Toda and Kota men will be found on page 215. The following summary, based on the averages, will serve, however, to indicate the principal points of difference between male members of the two tribes.

The most obvious distinguishing character is the great development of the hairy system in the Toda, though the Kota frequently has hair well developed on his chest and abdomen. The weight and chest girth of the two tribes are approximately the same, but the mean Toda height is 6·7 cm. greater than that of the Kotas. Corresponding to a greater length of the upper extremities, the span of the arms (*i.e.*, the length from tip to tip of the middle finger with the arms extended at right angles to the body) is 6·7 cm. longer in the Toda than in the Kota, but the difference between height and span is exactly the same (5·4 cm.) in the Toda and Kota. The Todas are broader shouldered than the Kotas, and, though the former do far less manual labour than the latter (many of whom are blacksmiths), their hand grip, as tested by a Salter's dynamometer, is considerably (9 lbs.) greater. The Kotas have broader hips, but a shorter and narrower foot than the Todas. Both Todas and Kotas are dolichocephalic. The cephalic breadth averages the same in the two tribes, but the length of the head is very slightly (·2 cm.) greater in the Toda. The Kota has a wider face with more prominent cheek bones, a greater bimalar breadth, a wider lower jaw, and more developed zygomatic arches. The Toda nose is slightly longer and broader than that of the Kotas. The height from the top of the head (vertex) to the chin is slightly less in the Kota than in the Toda; but corresponding to the greater length from the vertex to the tragus and the more developed frontal region, the facial angle (angle of Cuvier) of the Kota is in excess (3°) of that of the Toda.

The present bulletin is, I trust, only the first of a series giving in detail the results of an anthropological survey of the inhabitants of Southern India, the progress of which must perforce be slow and spasmodic. For the moment I must rest content with merely placing on record the main facts relating to the anthropography and ethnography of the Todas and Kotas, leaving the conclusions to be drawn hereafter, when sufficient material has been collected for the purpose of co-ordination.

NOTE ON KOTA DEATH CEREMONIES.

At the time of writing the foregoing account of the Kotas, I had had no opportunity of witnessing their death ceremonies, and was compelled to base my meagre account thereof on the description given to me by my Kota informant. A few days after my arrival at Kotagiri in the present year, with a view to investigating the Badagas and Irulas, the dismal sound of mourning, to the weird strains of the Kota band, announced that death reigned in the Kota village, and the opportunity was seized to be present as an eye-witness of the ceremonies.

The dead man was a venerable carpenter (No. 3, p. 190) of high position in the community, and the death rites were accordingly carried out on a lavish scale. Soon after day-break a detachment of villagers hastened to convey the tidings of the death to the Kotas of the neighbouring villages, who arrived on the scene later in the day in Indian file, men in front and women in the rear. As they drew near to the place of mourning, they all, of one accord, commenced the orthodox manifestations of grief, and were met by a deputation of villagers accompanied by the band.

Meanwhile a red flag, tied to the top of a bamboo pole, was hoisted as a signal of death in the village, and a party had gone off to a glade, some two miles distant, to obtain wood for the construction of the funeral car (*tëru*). The car, when completed, was an elaborate structure, about eighteen feet in height, made of wood and bamboo, in four tiers, each with a canopy of turkey red and yellow cloth, and an upper canopy of white cloth trimmed with red, surmounted by a black umbrella of European manufacture, decorated with red ribbands. The car was profusely adorned throughout with red flags and long white streamers, and with young plantain trees at the base. Tied to the car were a calabash and a bell.

During the construction of the car the corpse remained within the house of the deceased man, outside which the relatives and villagers continued mourning to the dirge-like music of the band, which plays so prominent a part at the death ceremonies of both Todas and Kotas. On the completion of the car, late in the afternoon, it was deposited in front of the house. The corpse dressed up in a coloured

turban and gaudy coat as for a nautch party, with a garland of flowers round the neck, and two rupees, a half rupee, and sovereign, gummed on to the forehead, was brought from within the house, lying face upwards on a cot, and placed beneath the lowest canopy of the car. Near the head were placed iron implements and a bag of rice, at the feet a bag of tobacco, and beneath the cot baskets of grain, rice, cakes, &c. The corpse was covered by cloths offered to it as presents, and before it those Kotas who were younger than the dead man prostrated themselves, while those who were older touched the head of the corpse and bowed to it. Around the car the male members of the community executed a wild step-dance, keeping time with the music in the execution of various fantastic movements of the arms and legs.

During the long hours of the night mourning was kept up to the almost incessant music of the band, and the early morn discovered many of the villagers in an advanced stage of intoxication. Throughout the morning dancing round the car was continued by men, sober and inebriated, with brief intervals of rest, and a young buffalo was slaughtered as a matter of routine form, with no special ceremonial, in a pen outside the village, by blows on the back and neck administered with the keen edge of an adze. Towards midday presents of rice from the relatives of the dead man arrived on the back of a pony, which was paraded round the funeral car. From a vessel containing rice and rice water, rice was crammed into the mouths of the near relatives, some of the water poured over their heads, and the remainder offered to the corpse. At intervals a musket, charged with gunpowder, which proved later on a dangerous weapon in the hands of an intoxicated Kota, was let off, and the bell on the car rung.

About 2 P.M., the time announced for the funeral, the cot bearing the corpse, from the forehead of which the coins had been removed, was carried outside the village, followed by the widow and a throng of Kotas of both sexes, young and old, and the car was carried to the foot of the hill, there to await the arrival of the corpse after the performance of various ceremonies. Seated together at some distance from the corpse, the women continued to mourn until the funeral procession was out of sight, those who could not cry spontaneously, or compel the tears to flow, mimicking the expression of woe by contortion of the grief muscles. The most poignant grief was displayed by a man, in a state of

extreme intoxication, who sat apart by himself, howling and sobbing, and wound up by creating considerable disturbance at the burning ground. Three young bulls were brought from the village, and led round the corpse. Of these, two were permitted to escape for the time being, while a vain attempt, which would have excited the derision of the expert Toda buffalo catchers, was made by three men hanging on to the head and tail to steer the third bull up to the head of the corpse. The animal, however, proving refractory, it was deemed discreet to put an end to its existence by a blow on the poll with the butt-end of an adze, at some distance from the corpse, which was carried up to it, and made to salute the dead beast's head with the right hand in feeble imitation of the impressive Toda ceremonial. The carcase of the bull was saluted by a few of the Kota men, and subsequently carried off by pariahs.

Supported by females, the exhausted widow of the dead man, who had fainted earlier in the day, was dragged up to the corpse, and, lying back beside it, had to submit to the ordeal of removal of all her jewelry, the heavy brass bangle being hammered off the wrist, supported on a wooden roller, by oft repeated smart blows with mallet and chisel, delivered by a village blacksmith assisted by a besotten individual noted as a consumer of twelve grains of opium daily. The ornaments, as removed, were collected in a basket, to be worn again by the widow after several months.

This revolting ceremony concluded, and a last salutation given by the widow to her dead husband, arches of bamboo were attached to the cot, which was covered over with a coloured table cloth hiding the corpse from sight. A procession was then formed, composed of the corpse on the cot, preceded by the car and musicians, and followed by male Kotas and Badagas, Kota women carrying the baskets of grain and cakes, a vessel containing fire, burning camphor, and, bringing up the rear, a high dignitary of the church, an amateur photographer, and myself. Quickly the procession marched to the burning ground beyond the bazár, situated in a valley by the side of a stream running through a glade in a dense undergrowth of bracken fern and trailing passion-flower. On arrival at the selected spot, a number of agile Kotas swarmed up the sides of the car, and stripped it of its adornments, including the umbrella, and a free fight for the possession of the cloths and flags ensued. The denuded car was then placed over the corpse, which, de-

prived of all valuable ornaments, and still lying on the cot face upwards, had been meanwhile placed, amid a noisy scene of brawling, on the rapidly constructed funeral pyre. Around the car faggots of fire-wood, supplied, in lieu of wreaths, by different families in the dead man's village, as a tribute of respect to the deceased, were piled up, and the pyre was lighted with torches kindled at a fire which was burning on the ground close by. As soon as the pyre was in a blaze, tobacco, cheroots, cloths, and grain were distributed among those present, and the funeral party dispersed, discussing the events of the day as they returned to their homes, leaving a few men behind in charge of the burning corpse. And peace reigned once more in the Kota village.

A few days later the funeral of an elderly Kota woman took place with a very similar ceremonial. But, suspended from the handle of the umbrella on the top of the car, was a rag doll, which, in appearance, resembled an 'Aunt Sally.'

NOTE ON KOTA ANNUAL FESTIVAL.

The following note is a translation of a description by Dr. Emil Schmidt (*Reise nach Süd-Indien*, 1894) of the dancing at the Kota annual festival, at which he had the good fortune to be present as an eye-witness :—

"During my stay at Kotagiri the Kotas were celebrating the big festival in honour of their chief god. The feast lasted over twelve days, during which homage was offered to the god every evening, and a dance performed round a fire kept burning near the temple throughout the feast. On the last evening but one, females, as well as males, took part in the dance. As darkness set in, the shrill music, which penetrated to my hotel, attracted me to the Kota village. At the end of the street, which adjoins the back of the temple, a big fire was kept up by continually putting on large long bundles of brushwood. On one side of the fire, close to the flames, stood the musicians with their musical instruments, two hand-drums, a tambourine, beaten by blows on the back, a brass cymbal beaten with a stick, and two pipes resembling oboes. Over and over again the same monotonous tune was repeated by the two latter in quick four-eight time to the accompaniment of

the other instruments. On my arrival, about forty male Kotas, young and old, were dancing round the fire, describing a semi-circle, first to one side, then the other, raising the hands, bending the knees, and executing fantastic steps with the feet. The entire circle moved thus slowly forwards, one or the other from time to time giving vent to a spout that sounded like Hau! and, at the conclusion of the dance, there was a general shout all round. Around the circle, partly on the piles of stone near the temple, were seated a number of Kotas of both sexes. A number of Badagas of good position, who had been specially invited to the feast, sat round a small fire on a raised place, which abuts on the back wall of the temple.

"The dance over, the circle of dancers broke up. The drummers held their instruments, rendered damp and lax by the moist evening breeze, so close to the flames that I thought they would get burnt. Soon the music began again to a new tune; first the oboes, and then, as soon as they had got into the proper swing, the other instruments. The melody was not the same as before, but its two movements were repeated without intercession or change. In this dance females, as well as males, took part, grouped in a semi-circle, while the men completed the circle. The men danced boisterously and irregularly. Moving slowly forwards with the entire circle, each dancer turned right round from right to left and from left to right, so that, after every turn, they were facing the fire. The women danced with more precision and more artistically than the men. When they set out on the dance, they first bowed themselves before the fire, and then made left and right half turns with artistic regular steps. Their countenances expressed a mixture of pleasure and embarrassment. None of the dancers wore any special costume, but the women, who were nearly all old and ugly, had, for the most part, a quantity of ornaments in the ears and nose and on the neck, arms and legs.

"In the third dance, played once more in four-eight times, only females took part. It was the most artistic of all, and the slow movements had evidently been well rehearsed beforehand. The various figures consisted of stepping radially to and fro, turning, stepping forwards and backwards, etc., with measured seriousness and solemn dignity. It was for the women, who, at other times, get very little enjoyment, the most important and happiest day in the whole year."

TABLE I.

SUMMARY OF MEASUREMENTS.

TODA MEN.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Weight	135	98	115·4	124·1	105	15 measurements. Average height 168·3 cm.
Hand dynamometer.	100	60	79	87	71	Two men not measured, 112 and 105.
Height	179	159·2	169·6	173·7	164·4	
Height, sitting ...	94·2	82·3	87·9	90	85	
Height, kneeling...	132·8	118·4	124·8	128·6	121	
Height to gladiolus.	136	113	124·4	128·2	121	
Span of arms ...	188·8	164·2	175	180	170·4	
Chest	88·5	77	83	85·7	80·2	
Middle finger to patella.	13	5·9	9	10·7	7·9	16 measure- ments.
Shoulders ...	42	37	39·3	40·2	38·5	
Cubit	50·3	43·5	47	48·4	45·4	
Hand, length ...	20	18	18·8	19·1	18·3	
Hand, breadth ...	9·2	7·4	8·1	8·5	7·8	
Middle finger, ...	12·7	11	12	12·3	11·6	
Hips	29·2	23·3	25·7	26·6	24·7	
Foot, length ...	27·9	24·2	26·2	27·3	25·4	
Foot, max. breadth.	10·6	8·1	9·2	9·9	8·6	
Cephalic length ...	20	18·3	19·4	19·7	19	
Cephalic breadth.	15·2	13·6	14·2	14·6	13·9	
Cephalic index ...	77·6	69·2	73·3	74	71	

TABLE I—*continued.*SUMMARY OF MEASUREMENTS—*continued.*TODA MEN—*continued.*

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Bigoniac	10·2	8·2	9·6	9·9	9·3	
Bizygomatic	13·8	12	12·7	13·1	12·5	
Maxillo-zygomatic index.	82	67·8	75·7	79·2	73·7	
Nasal height	5·3	4·5	4·7	4·9	4·6	
Nasal breadth	4·1	3	3·6	3·8	3·4	
Nasal index	89·1	61·2	74·9	79·9	70	
Vertex to tragus...	14·2	12	13	13·6	12·6	
Vertex to chin	22·5	19·3	21	21·6	20·3	
Facial angle	73	62	67	69	65	

Note.—In estimating the mean deviation above and below the average, those measurements which were exactly equal to the mean were equally distributed above and below.

The weight is recorded in pounds; the measurements are in centimètres. Excepting where otherwise indicated, it may be understood that the results are based on the examination of twenty-five subjects.

The following average measurements of twenty-five Thiyans belonging to the Malabar Police force are recorded for comparison with those of the Todas:—

	Thiyan.	Toda.
Height	172	169·6
Span of arms	179·6	175
Chest	85·4	83
Shoulders	40·2	39·3
Cubit	48	47
Foot, length	27	26·2

TABLE II.
SUMMARY OF MEASUREMENTS.
TODA WOMEN,

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Weight	119·5	84·5	100·5	109·5	91·7	
Height	165·6	146·5	155·6	159·7	151·2	
Height, sitting ...	86·6	76	81·7	83·9	79·7	
Height, kneeling...	122·2	109	114·7	118·5	111·8	
Span of arms ...	172	145	160·8	165·3	156	
Chest (round arm- pits).	86	72	77·7	80·3	75·4	
Shoulders ...	36·5	32·6	34·5	35·1	33·7	
Cubit	47·3	38·9	43·6	45·2	42·7	
Hand, length ...	18·8	16	17·4	17·8	16·8	22 measure- ments.
Hand, breadth ...	7·8	5·7	7·2	7·5	6·8	
Middle finger ...	11·8	10·3	11·1	11·4	10·9	
Foot, length ...	25·4	21·8	23·8	24·4	23	
Foot, max : breadth.	8·2	6·6	7·6	7·9	7·2	21 measure- ments.
Cephalic length ...	19·7	17·1	18·4	18·9	17·9	
Cephalic breadth.	14·3	13	13·6	14	13·4	
Cephalic index ...	77·8	70	73·9	75	72·1	
Bigóniac	10	8·7	9·4	9·7	9	
Bizygomatic ...	13	11·5	12·1	12·4	11·7	

Note.—Excepting where otherwise indicated, the results are based on the examination of twenty-five subjects.

TABLE II—*continued.*SUMMARY OF MEASUREMENTS—*continued.*TODA WOMEN—*continued.*

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Maxillo-zygomatic index.	82.6	74.2	77.4	79.7	75.6	
Nasal height ...	4.9	3.4	4.2	4.5	4	
Nasal breadth ...	3.5	3	3.2	3.3	3.1	
Nasal index ...	91.2	63.3	75.5	78.6	70.9	
Vertex to tragus...	13.8	11.9	12.8	13.3	12.5	
Vertex to chin ...	21.5	18.3	19.7	20.7	18.9	
Facial angle ...	73	61	68	70	66	

TABLE III.

SUMMARY OF MEASUREMENTS.

KOTA MEN.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Weight	147	99·5	115	124	109	20 measurements.
Hand dynamometer.	105	55	70	79	62	
Height	174·2	155	162·9	166·2	158·9	
Height, sitting ...	90·4	82·2	85·8	87·5	83·9	
Height, kneeling...	126·4	112·4	120	122·8	116·4	
Height to gladiolus.	129·2	115	120·6	123·8	118	
Span of arms ...	181·4	155·6	168·3	172	163·7	
Chest	91	77·5	83·3	85·4	81·5	
Middle finger to patella.	13·6	7·4	10·7	11·7	9·2	22 measurements.
Shoulders ...	40·7	34·8	37·7	38·7	36·6	
Cubit	48·6	42·2	45·1	46·2	43·8	
Hand, length ...	19	16·5	18	18·4	17·5	
Hand, breadth ...	8·6	7·4	8	8·3	7·7	
Middle finger ...	12·6	10·7	11·5	11·8	11·2	
Hips	30·4	25·8	27	27·7	26·5	
Foot, length ...	26·3	23·6	25·2	25·7	24·8	
Foot, max. breadth.	9·5	8·1	8·8	9·1	8·5	22 measurements.
Cephalic length ...	20·2	18·3	19·2	19·6	18·8	
Cephalic breadth...	15·1	13·4	14·2	14·5	13·9	
Cephalic index ...	79·1	69·9	74·1	76	72	
Bigoniac ...	10·9	9·1	10·1	10·4	9·8	

TABLE III—*continued.*SUMMARY OF MEASUREMENTS—*continued.*KOTA MEN—*continued.*

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Bizygomatic ...	13·9	12·1	13	13·3	12·6	
Maxillo-zygomatic index.	85·1	70	77·9	80·4	75·3	
Nasal height ...	5	4·1	4·5	4·7	4·3	
Nasal breadth ...	4	3·1	3·5	3·7	3·3	
Nasal index ...	92·9	64	77·2	83·1	70·5	
Vertex to tragus...	14·9	12·8	13·7	14·2	13·4	
Vertex to chin ...	22·7	19·1	20·8	21·6	19·9	
Facial angle ...	73	66	70	71	69	

Note.—In estimating the mean deviation above and below the average, those measurements which were exactly equal to the mean were equally distributed above and below.

The weight is given in pounds ; the measurements are in centimetres. Excepting where otherwise indicated, the results are based on twenty-five measurements.

TABLE IV.

SUMMARY OF MEASUREMENTS.

KOTA WOMEN.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Weight	97	72	86	90	83	15 measurements.
Height	154·6	138·8	146·3	150·1	142·6	
Height, sitting ...	80·	73·6	77·4	78·9	75·6	
Height, kneeling...	114·6	103·4	108·3	110·5	105·4	
Span of arms ...	162·2	143·8	151·2	156·1	145·8	19 measurements.
Shoulders	35·7	31·1	33·4	34·2	32·5	
Cubit	42·7	37·7	40·2	41·5	39	
Hand, length ...	17·8	16	16·6	17·2	16·3	
Hand, breadth ...	7·8	6·7	7·3	7·6	7·1	
Middle finger ...	11·2	10·2	10·6	10·8	10·4	19 measurements.
Foot, length ...	25	21·3	22·9	23·5	22·3	
Foot, max. breadth.	8·4	7·1	7·7	8·1	7·3	17 measurements.
Cephalic length ...	19·1	17·4	18·2	18·6	17·8	
Cephalic breadth...	14·5	13·1	13·7	14·1	13·3	
Cephalic index ...	79·2	71	74·9	76·9	72·5	
Bigoniac	10·3	9	9·4	9·7	9·1	
Bizygomatic ...	12·9	11·7	12·3	12·6	11·9	
Maxillo-zygomatic index.	83·7	70·7	76·8	78·3	74·8	
Nasal height ...	4·8	3·3	4·2	4·4	4	
Nasal breadth ...	3·4	2·9	3·2	3·3	3·1	
Nasal index ...	89·5	70·7	76	80·2	72·1	

TABLE IV—*continued.*SUMMARY OF MEASUREMENTS—*continued.*KOTA WOMEN—*continued.*

	Maximum.	Minimum.	Average.	Mean above.	Mean below.	
Vertex to tragus...	13·9	12·2	13·1	13·4	12·9	
Vertex to chin ...	21·5	17·6	19	19·5	18·5	
Facial angle ...	73	68	70	71	69	15 measurements.

Note.—Excepting where otherwise indicated, the results are based on twenty measurements.

TABLE V.
COMPARISON OF MEASUREMENTS.
TODA AND KOTA MEN.

	Todas.	Kotas.
Weight	115·4	115
Height	169·6	162·9
Height, sitting	87·9	85·8
Height, kneeling	124·8	120
Height to gladiolus	124·4	120·6
Span of arms	175	168·3
Chest	83	83·3
Middle finger to patella	9	10·7
Shoulders	39·3	37·7
Cubit	47	45·1
Hand, length	18·8	18
Hand, breadth	8·1	8
Middle finger	12	11·5
Hips	25·7	27
Foot, length	26·2	25·2
Foot, breadth	9·2	8·8
Cephalic length	19·4	19·2
Cephalic breadth	14·2	14·2
Cephalic index	73·3	74·1
Bigoniac	9·6	10·1
Bizygomatic	12·7	13

TABLE V—*continued.*COMPARISON OF MEASUREMENTS—*continued.*TODA AND KOTA MEN—*continued.*

	Todas.	Kotas.
Maxillo-zygomatic index	75·7	77·9
Nasal height	4·7	4·5
Nasal breadth	3·6	3·5
Nasal index	74·9	77·2
Vertex to tragus	13	13·7
Vertex to chin	21	20·8
Facial angle	67	70

THE BRÁHMANS, KAMMÁLANS, PALLIS, AND PARIHAHS OF MADRAS CITY.

Looking at the table on page 230, I picture to myself the sad feelings of a candidate at an examination in anthropology, overflowing with parrot knowledge of his text books, on being presented with the following examination paper:—

Saturday, 20th January, 2 to 5 P.M.

ANTHROPOLOGY.

Draw such conclusions as you are able from the figures in the table supplied.

The table, based on measurements recorded by myself, affords fitting material for an essay on comparative anthropology, and, reverting for once to the position of candidate, I will answer, in my own way, the question set by myself as examiner.

At first sight a complicated jumble of figures, the table resolves itself naturally into three primary groups, viz:—

1. Todas of the Nilgiris, above middle height (170 to 165 cm.), with a difference of only 5·4 cm. between the span of the arms and height, a distance of 9 cm. from the middle finger to the patella, a head conspicuously long in proportion to its breadth, and long, narrow nose.

2. Bráhmans, Kammálans, Pallis, and Pariahs below middle height (165 to 160 cm.) with a difference between the span of the arms and height ranging from 11·4 to 9·4 cm., the distance from middle finger to patella varying between 8·4 and 10·1 cm., and a nasal index ranging from 77·2 to 84·5.

3. Paniyans of the Wynád, of low stature, with a difference of 7·8 cm. between the span of the arms and height, a distance of 7·3 cm. from middle finger to patella, a long hand, and broad, short nose with a very high nasal index (95·1).

In placing the Kammálans as "below middle height," I give them the benefit of the three millimetres below the minimum (160 cm.), as they should be sharply separated from the various people (Muppas, Cherumans, Kurumans,

Paniyans, &c.), whose mean height is uniformly between 157 and 158 cm.

With the Todas I have already dealt in detail. With the Paniyans I shall deal in like manner hereafter. Suffice it, for the moment, to state that they are a short, curly (not wooly) headed, broad-nosed people, inhabiting the Wynád and plains of Malabar, who are popularly believed (with no evidence in support of the belief) to be of African descent. In the present essay I shall confine myself mainly to a consideration of the Bráhmans belonging to the poorer classes, Kammálans, Pallis, and Pariahs of Madras city, based, in each case, on measurements of forty adult men, varying in age from twenty-five to forty, and taken at random.

It may be contended that it is not possible to arrive at an average, in the case of a large community, such, for example, as the Bráhmans, by measurement of so few individuals as forty. I, therefore, produce in evidence of the fairness of the figures recorded in table VI, table VII, in which the mean measurements, as estimated after ten, twenty, thirty, and forty measurements, are given. The results show, in a very marked manner, that each series of ten individuals conformed, as regards weight and measurements of the head, trunk, and extremities, to the same type. More especially would I invite attention to the measurements of the height, head, and nose. Taking some of the more important factors in table VII, and examining the greatest deviation from the averages, the results are as follows:—

Greatest deviation.

2·5 cm. = 1 inch.

1 mm. = .1 cm.

Height	1·1 cm.
Span of arms	1·3 „
Hand, length	3 mm.
Foot, length	2 „
Cephalic length	1 „
Cephalic breadth	1 „
Nasal height	1 „
Nasal breadth	1 „

The Bráhmans, who returned themselves as Mádhava, Smarta, Sóliya, and Vaishnava, belonged to the classes of agriculturist, clerk, gurú, mendicant, and schoolmaster.

The Kammálans comprised blacksmiths, carpenters, stonemasons, and goldsmiths; the Pallis, cultivators, fitters, gardeners, hand-cart draggers, masons, polishers, and sawyers;

the Pariahs, coachmen, coolies, dressing-boys, fish-sellers, gardeners, and horse-keepers.

It would be impossible, within the limits of a single, essay, to deal at length with the "manners and customs," history, religion, &c., of the Bráhmans, Kammálans, Pallis, and Pariahs: and I cannot do better than reproduce the epitomes contained in my constant companion, the Madras Census Report, 1891, wherein Mr. H. A. Stuart has brought together, for the benefit of the anthropologist, a vast store of information, both statistical and general.

1. BRÁHMANS.

"It has often been asserted, and is now the general belief of ethnologists, that the Bráhmans of the South are not pure Aryans, but are a mixed Aryan and Dravidian race. In the earliest times the caste division was much less rigid than now, and a person of another caste could become a Bráhman by attaining the Bráhmanical standard of knowledge, and assuming Bráhmanical functions. And, when we see Nambúdiri Bráhmans even at the present day contracting alliances, informal though they be, with the women of the country, it is not difficult to believe that, on their first arrival, such unions were even more common, and that the children born of them would be recognised as Bráhmans, though perhaps regarded as an inferior class. However, those Bráhmans, in whose veins the mixed blood is supposed to run, are even to this day regarded as lower in the social scale, and are not allowed to mix freely with the pure Bráhman community."

2. KAMMÁLANS.

"The name Kammála is a generic term applied to the five artisan castes, viz., (1) Tattán or Kamsala (goldsmith); (2) Kannán or Kanchara (brazier); (3) Kollan or Kammara (blacksmith); (4) Tac'chan or Vadra (carpenter); and (5) Kal Tac'chan or Silpi (stone-mason). The Kammálas assert that they are descended from Visvakarma, the architect of the

gods, and, in many parts of the country, they claim to be equal with the Bráhmans, calling themselves Visva Bráhmans.

Inscriptions show that, as late as the year 1033 A.D., the Kammálans were treated as a very inferior caste, for they, like the Paraiyans, Pallans, &c., were confined to a particular part or *chéri* of the village site. . . . The five main sub-divisions of the Kammálans do not generally intermarry. They have priests of their own, and do not allow even Bráhmans to officiate for them, but they imitate the Bráhmans in their ceremonies. Girls must be married before puberty, and widow re-marriage is strictly prohibited. The use of flesh and alcohol is also nominally forbidden. Many of them bury the dead in a sitting posture, but cremation is also practised. Their usual title is Achári, and some call themselves *Pattan*, which is the equivalent of the Bráhman Bhatta. To this account may be added the fact that the Kammálans wear the sacred thread."

3. PALLIS.

"The Pallis, Vanniyans, or Padaiyáchis, are found in all the Tamil districts That the Pallis were once an influential and independent community may be admitted, and, in their present desire to be classed as Kshatriyas, they are merely giving expression to their belief, but, unless an entirely new meaning is given to the term 'Kshatriya,' their claim must be dismissed as absurd. After the fall of the Pallava dynasty the Pallis became agricultural servants under the Vallálas, and it is only since the advent of British rule that they have begun to assert their claims to a higher position. The bulk of them are still labourers, but many now farm their own lands, while others are engaged in trade.

"They do not wear the sacred thread. Some of them engage Bráhmans to officiate as their priests. Their girls are usually married after they attain maturity. The re-marriage of widows is permitted, and actually practised. Divorce is said to be permitted only in case of adultery by the wife, but this statement requires confirmation. They both burn and bury the dead. Their usual agnomen is Kavandan or Padaiyáchi, but some of them, who strive for a higher social standing, call themselves 'Náyakkan.'"

4. PARIAS.

“The Paraiyan or Pariah caste of the Tamil country numbers, according to the census, over two million souls. . . . The tribe must at one time have held an influential position, for there are curious survivals of this in certain privileges which Paraiyans have retained to the present day. I quote the following remarks of Mr. Walhouse on this subject :—

“It is well known that the servile castes in Southern India once held far higher positions, and were indeed masters of the land on the arrival of the Bráhmancial caste. Many curious vestiges of their ancient power still survive in the shape of certain privileges, which are jealously cherished, and, their origin being forgotten, are misunderstood. These privileges are remarkable instances of survivals from an extinct order of society. Shadows of long-departed supremacy, bearing witness to a period when the present haughty high-caste races were suppliants before the ancestors of degraded classes, whose touch is now regarded as pollution. At Mélkotta, the chief seat of the followers of Rámánuja-áchárya, and at the Bráhman temple at Bailur, the Holeyars or Pareyars have the right of entering the temple on three days in the year, specially set apart for them. . . . In the great festival of Siva at Tiruválúr in Tanjore, the headman of the Pareyars is mounted on the elephant with the god, and carries his *chauri*. In Madras, at the annual festival of the goddess of Black Town, when a *táli* is tied round the neck of the idol in the name of the entire community, a Pareyar is chosen to represent the bridegroom.’

“‘The Paraiyans have been but little affected by Bráhmancial doctrines and customs, though in respect to ceremonies they have not escaped their influence. Paraiyans are nominally Saivites, but in reality they are demon-worshippers. The Valluvas are their priests. The marriage of girls before puberty is very rare. Divorce is easy; a husband can send his wife away at will, and she on her part can dissolve the marriage tie by simply returning the *táli*. In such cases the husband takes the children, or contributes for their maintenance. Widow marriage is freely allowed. The dead are usually buried.’”

Turning now to a detailed analysis of the figures in table VI, with more special reference to the Bráhmans,

Kammálans, Pallis, and Pariahs. The Bráhmans are the best nourished, as indicated by the weights, which, relative to stature = 100, are as follows:—Bráhmans 70·8; Pariahs 65·4; Pallis 64·4; Kammálans 62·9 lbs. In height the Bráhmans, Pallis, and Pariahs are very closely allied, and differentiated from the Kammálans, as shown by the following table ²⁰:—

	Average.	Mean above.	Mean below.
Bráhmans 	162·5	167·9	157·1
Pallis 	162·5	166·7	157·5
Pariahs 	162·1	166·3	157·4
Kammálans 	159·7	164·1	155·2

The relative lengths of the upper extremities are best determined by a comparison of the *grande envergure* (span of arms) with the height, and of the distance from the middle finger to the patella.

The difference between the span of the arms and height ranges between 10 cm. and 10·8 cm. in the Bráhmans, Pallis, and Pariahs, and is over 11 cm. in the Kammálans; or, expressed relatively to stature = 100, and compared with the averages of English and Negroes, the results are as follows:—

English	..	..	..	104·4
Pariahs	..	..	..	106·2
Pallis	..	..	..	106·2
Bráhmans	..	..	..	106·6
Kammálans	..	..	..	107·1
Negroes	..	..	..	108·1

The results, then, in the classes under review, range between those of the English and Negroes, of whom the latter, owing to the great length of the upper extremities, have a very wide span.

The distance from the tip of the middle finger to the top of the patella (the extensor muscles of the thigh being

²⁰ In this and subsequent tables the measurements are recorded in centimetres.

relaxed) diminishes as the length of the upper extremities is greater. It is greatest in the Bráhmans, least in the Kammálans, and intermediate (and, as in the case of the span, the same) in the Pallis and Pariahs. The following table gives the results, relative to stature=100, as compared with the results of measurement of American soldiers, Negroes, and the Paniyans of the Wynád :—

American soldiers	..	..	7·5
Bráhmans	..	..	6·2
Pallis	..	..	5·8
Pariahs	..	..	5·8
Kammálans	..	..	5·3
Paniyans	..	..	4·6
Negroes	..	..	4·4

As in the case of the difference between span and height, the classes under review come between the white men and the Negroes, to the latter of whom the short, broad-nosed Paniyans approximate most closely.

Once again, the length of the hand is practically the same in the Pallis and Pariahs, who come between the long-handed Bráhmans and short-handed Kammálans. But, in length of foot, the Bráhmans and Pariahs (whose average foot-length is practically the same) exceed the Pallis and Kammálans. A long hand or foot, it may be noted, *en passant*, is not considered a characteristic of inferiority.

I take this opportunity of correcting an error in Topinard's 'Anthropology,' based on the rough tape measurements of Dr. Shortt, to the effect that the Toda foot is "monstrously large," viz., 18·1 relative to stature = 100. My measurements were made with a sliding scale on twenty-five Toda men taken at random, and gave the following results :—

	Maximum.	Minimum.	Average.	Mean above.	Mean below.
Actual	27·9	24·2	26·2	27·3	25·4
Relative to stature=100.	16·9	14·6	15·4	16	15·1

So far, then, from the length of the Toda foot being monstrously large, it is, as shown by the following table,

shorter, relative to stature, than that of all, except one, of the classes or tribes of Southern India, whose investigation I have, up to the present time, completed :—

	Height.	Length of foot.	Length of foot relative to stature =100.
Kongas	159	25·5	16·1
Kammálans	159·7	25·1	16
Pariahs	162·1	26	16
Bráhmans	162·5	25·9	15·9
Paniyans	157·4	25	15·9
Cherumans	157·5	24·7	15·7
Pallis	162·5	25·5	15·7
Irulas	159·8	24·9	15·6
Muppas	157·7	24·5	15·5
Kotas	162·9	25·2	15·5
Todas	169·6	26·2	15·4
Badagas	164·1	25	15·2

Though not included in table VI, the relation of the breadth of the hips, across the spines of the ilia, to the length of the foot, appears to me to serve as a distinguishing characteristic between different races, castes, and tribes. I, therefore, reproduce the results so far as my investigations permit :—

	Foot length.	Hips breadth.	Foot.	Hips.
Kotas	25·2	27	...	+ 1·8
Badagas	25	26·6	...	+ 1·6
Irulas	24·9	25·4	...	+ ·5
Bráhmans	25·9	26	...	+ ·1
Kongas	25·5	25·6	...	+ ·1
Paniyans	25	24·3	+ ·7	...
Todas	26·2	25·7	+ ·5	...
Cherumans	24·7	24·2	+ ·5	...
Muppas	24·5	24·1	+ ·4	...
Pariahs	26	25·9	+ ·1	...
Kammálans	25·1	25·1	— 0	— 0
Pallis	25·5	25·5	— 0	— 0

This table shows that, in the classes under review, and in the Kongas, the breadth of the hips and length of the foot are practically equal, whereas in the Badagas, Kotas, and Irulas the length of the foot is appreciably shorter, and in the Todas, Paniyans, Cherumans, and Muppas, longer than the breadth of hips.

Passing on to a consideration of the measurements of the head, it may be stated at the outset that the Bráhmans are separated, not only from the Kammálans, Pallis, and Pariahs, but also, as shown in the following table, from all the other classes or tribes of Southern India which I have as yet investigated, with the exception of the Kongas of Coimbatore, by the relation of the maximum transverse diameter to the maximum antero-posterior diameter of the head (cephalic index). Though the cephalic index of the Kongas is slightly greater, the mean length and breadth of their heads are considerably less than those of the Bráhmans, being only 17·8 cm. and 13·7 cm. against 18·6 cm. and 14·2 cm.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.
Badagas	77·5	66·1	71·7	73·9	69·5
Muppas	77·1	62·3	72·3	74·5	70·3
Pallis	80	64·4	73	75·5	70·1
Todas	77·6	69·2	73·3	74	71
Pariahs	78·3	64·8	73·6	75·5	71·4
Cherumans	80·1	67·7	73·9	76·3	71·7
Paniyans	81·1	69·4	74	76·3	72
Kotas	79·1	69·9	74·1	76	72
Kammálans	81·5	68·4	75	77·8	72·2
Irulas	80·9	70·8	75·8	78	73·8
Bráhmans	84	69	76·5	78·9	73·6
Kongas	81·7	70	77	78·2	74·2

The results of measurements of the length of the head of Bráhmans, Kammálans, Pallis, and Pariahs show that the average length is the same in all except the Kammálans, in whom it is slightly (·2 cm.) shorter.

CEPHALIC LENGTH.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.
Bráhmans	19·9	17·3	18·6	19·1	18·2
Kammálans	19·7	17·3	18·4	18·9	17·8
Pallis	19·6	17·4	18·6	19	18·2
Pariahs	19·7	17	18·6	19·1	18·2

The results of measurement of the breadth of the head, on the other hand, show that the average breadth of the Bráhma-man head is considerably in excess of that of the Kammálans, Pallis, and Pariahs.

CEPHALIC BREADTH.

	Maximum.	Minimum.	Average.	Mean above.	Mean below.
Bráhmans	15·2	12·7	14·2	14·6	13·7
Kammálans	14·7	13·1	13·7	14	13·4
Pallis	14·6	12·1	13·6	14	13·2
Pariahs	14·5	13	13·7	14	13·4

The great breadth of the Bráhman head, in comparison with that of the other three classes, is well brought out by the following table, which gives the number of times in which the head of members of each class measured between 12 and 13, 13 and 14, 14 and 15, and 15 and 16 centimetres respectively:—

	12-13	13-14	14-15	15-16	Total.
Bráhmans	1	9	27	3	40
Kammálans	1	22	17	...	40
Pallis	3	30	7	...	40
Pariahs ... ..	..	27	13	...	40

The mean measurements of the nose of the Bráhmans, Kammálans, Pallis, and Pariahs, which are summed up in the following tables, and compared with those of the typical broad-nosed Paniyans, show that in all, except the Paniyans, the average breadth of the nose is the same, but the length is slightly greatest in the Bráhmans, and least in the Pariahs. A Bráhman school-master was the possessor of the longest nose (5·5 cm.), and a Pariah dressing-boy of the broadest (4·5 cm.). But, in the course of my investigation, I came across many dark-skinned Bráhmans, with high nasal index, with whom I for one should be sorry to claim Aryan kinship. More especially have I in mind a swarthy individual with a nose 4·1 cm. \times 3·9 cm. and, for a Bráhman, a monstrous nasal index of 95·1.

NASAL HEIGHT.

			Maximum.	Minimum.	Average.	Mean above.	Mean below.
Bráhmans	...	...	5·5	4·1	4·7	4·9	4·4
Kammálans	...	...	5·2	4·1	4·6	4·8	4·3
Pallis	...	...	5·1	4·1	4·6	4·8	4·4
Pariahs	...	...	5·1	4·1	4·5	4·8	4·3
Paniyans	...	...	4·8	3·3	4	4·2	3·7

NASAL BREADTH.

			Maximum.	Minimum.	Average.	Mean above.	Mean below.
Bráhmans	...	...	3·9	3	3·6	3·7	3·4
Kammálans	...	...	4	3·1	3·6	3·8	3·4
Pallis	...	...	4·1	3·1	3·6	3·8	3·4
Pariahs	...	...	4·5	3·1	3·6	3·8	3·4
Paniyans	...	...	4·2	3·2	3·8	4	3·6

NASAL INDEX.

			Maximum.	Minimum.	Average.	Mean above.	Mean below.
Bráhmans	...	...	95·1	60	76·7	82·2	71·6
Kammálans	...	...	90·9	63·3	77·3	82·6	72·5
Pallis	...	...	95·9	60·8	77·9	83·5	73·3
Pariahs	...	...	91·8	66	80	86	74·3
Paniyans	...	...	108·6	72·9	95·1	100·9	88·2

To sum up in a few words the distinguishing characteristics of Bráhmans, Kammálans, Pallis, and Pariahs, as deduced from the measurements. The Bráhmans are characterised by the greatest weight, greatest breadth of head, greatest distance from the middle finger to the patella, and the longest hand. The Kammálans are at once separated from the other three classes by shortness of stature, hand, and foot; and the Pallis and Pariahs are connected together by the close relation of their weight, height, difference between span and height, distance from the middle finger to the patella, and length of hand.

It must not for a moment be supposed that the present note is intended to be a final summing up of the characteristics, deduced from anthropometric observations, of the Bráhmans of Southern India. Rather does it represent the initial stage of an enquiry, in carrying out which I foresee difficulties resulting from dread of pollution by my instruments, especially the goniometer, which has to be held between the teeth when the facial angle is being determined.

Anthropological research among uneducated and superstitious people who believe in the efficacy of a thread in warding off the evil influence of devils, and are incapable of appreciating that one's motive is quite harmless, requires tact, bribery, coaxing, and a large store of patience. Last year, for example, the Paniyan women believed that I was going to have the finest specimens among them stuffed for the Madras Museum, and the Muppas of the Wynád were afraid that I was a recruiting sergeant, bent on enlisting the strongest men of their community for a native Malabar army; and, in a recent wandering on the lower slopes of the Nílگیرis, a man who was 'wanted' for some mild crime of ancient date, came to be measured, but absolutely refused to submit to the operation on the plea that he was afraid that the height measuring standard was the gallows. Nor would he permit me to take his photograph lest it should be used for the purpose of criminal identification.

TABLE VI.

	Weight.	Height.	Difference between span and height.	Middle finger to patella.	Hand, length.	Foot, length.	Cephalic length.	Cephalic breadth.	Nasal height.	Nasal breadth.	Nasal index.
Todas ...	115.4	169.6	5.4	9	18.8	26.2	19.4	14.2	4.7	3.6	74.9
Bráhmans ...	115	162.5	10.8	10.1	18.3	25.9	18.6	14.2	4.7	3.6	77.2
Kammálans ...	100.4	159.7	11.3	8.4	17.6	25.1	18.4	13.7	4.6	3.6	76.2
Pallis ...	104.6	162.5	10.1	9.5	17.9	25.5	18.6	13.6	4.6	3.6	77.9
Pariahs ...	106	162.1	10	9.4	17.9	26	18.6	13.7	4.5	3.6	80
Paniyans ...	99.6	157.4	7.8	7.3	18.5	25	18.4	13.6	4	3.8	95.1

TABLE VII.

BRÁHMANS.

(AVERAGES OF TEN, TWENTY, THIRTY AND FORTY MEASUREMENTS).

—	10	20	30	40
Weight	114·9	115·7	115	115
Height	163·3	163·6	162·3	162·5
Height, sitting	85·1	85·4	85·2	85·4
Height, kneeling	119·5	119·8	118·9	119·2
Height to gladiolus	121·8	122·4	121·6	122·1
Span of arms	174·6	173·4	172·9	173·3
Middle finger to patella	9·6	10·8	10·4	10·1
Shoulders	39·6	39·2	39·2	39·3
Cubit	46·5	46·1	45·9	46
Hand, length	18·4	18·2	18·1	18·3
Hand, breadth	8	8	8	8
Middle finger	11·7	11·5	11·5	11·6
Hips	25·8	25·7	25·9	26
Foot, length	26·1	26·1	25·9	25·9
Foot, breadth	8·5	8·7	8·7	8·7
Cephalic length	18·7	18·7	18·6	18·6
Cephalic breadth	14·2	14·3	14·2	14·2
Cephalic index	75·9	76·2	76·4	76·4
Bigoniac	10·2	10·1	10	10
Bizygomatic	12·8	12·9	12·9	12·9
Maxillo-zygomatic index	80	77·9	77·7	77·7
Nasal height	4·6	4·7	4·7	4·7
Nasal breadth	3·7	3·6	3·6	3·6
Nasal index	78·6	77·3	77·2	77·2
Vertex to tragus	14	14	14	14·1
Vertex to chin	20·8	20·8	20·7	20·9
Facial angle	68	69	68	69

Note.—In this and the following tables the weight is recorded in pounds; the measurements are in centimetres. The results are based in each table on the measurement of forty subjects.

TABLE VIII.
SUMMARY OF MEASUREMENTS.
BRÁHMANS.

—	Max.	Min.	Average.	Mean above	Mean below
Weight	161	90	115	132	107
Height	174·6	153	169·5	167·9	157·1
Height, sitting	90·8	81	85·4	87·8	83·2
Height, kneeling	127·8	108·2	119·2	122·9	115·7
Height to gladiolus	133·6	112·6	122·1	126·2	117·9
Span of arms	187·8	160	173·3	180	166·7
Chest	98	70	81	85·6	77·1
Middle finger to patella ...	14·8	4·8	10·1	12·1	8·5
Shoulders	43·7	34·6	39·3	41·3	34·2
Cubit	49·9	41·6	46	47·8	44·3
Hand, length	19·8	16·1	18·3	19·1	17·5
Hand, breadth	9·1	7·2	8	8·4	7·7
Middle finger	12·6	10·7	11·6	12	11·2
Hips	30·3	23	26	27·6	24·9
Foot, length	28·8	22·2	25·9	26·8	24·7
Foot, breadth	9·8	7·7	8·7	9·1	8·2
Cephalic length	19·9	17·3	18·6	19·1	18·2
Cephalic breadth	15·2	12·7	14·2	14·6	13·7
Cephalic index	84	69	76·5	78·9	73·6
Bigoniac	11·1	9	10	10·4	9·5
Bizygomatic	14·1	11·6	12·9	13·3	12·4
Maxillo-zygomatic index. ...	91·5	69·5	77·7	81·1	74·9
Nasal height	5·5	4·1	4·7	4·9	4·4
Nasal breadth	3·9	3	3·6	3·7	3·4
Nasal index	95·1	60	76·7	82·2	71·6
Vertex to tragus	14·7	12·8	14·1	14·5	13·5
Vertex to chin	22·9	18·1	20·9	21·5	20·2
Facial angle	74	61	69	71	66

TABLE IX.

SUMMARY OF MEASUREMENTS.

KAMMALANS.

—	Max.	Min.	Average.	Mean above	Mean below
Weight	130	79	100·4	111·5	92·2
Height	171·8	146·4	159·7	164·1	155·2
Height, sitting	88	75·6	82·5	84·4	80
Height, kneeling	126·2	107·2	117·4	120·3	114·3
Height to gladiolus	129·8	111·2	120	123·6	116·8
Span of arms	188·4	158·8	171	175·5	167
Chest	86	71	78	81·4	75·5
Middle finger to patella	13·4	4·2	8·4	10·6	6·8
Shoulders	42·8	36	39·2	40·7	38
Cubit	50·6	42·2	46·2	47·5	45
Hand, length	19	16·2	17·6	18·3	17·1
Hand, breadth	8·9	7·4	8·1	8·4	7·9
Middle finger	12·5	10·7	11·4	11·8	11·1
Hips	29	23·2	25·1	26·1	223·4
Foot, length	27·2	23·2	25·1	26·2	4·2
Foot, breadth	9·7	7·8	8·6	9	8·3
Cephalic length	19·7	17·3	18·4	18·9	17·8
Cephalic breadth	14·7	13·1	13·7	14	413·
Cephalic index	81·5	68·4	75	77·8	72·2
Bigoniac	11·1	8·6	9·7	10·3	9·2
Bizygomatic	13·3	11·6	12·7	13	12·4
Maxillo-zygomatic index	85·3	69·5	76·2	79·6	73·6
Nasal height	5·2	4·1	4·6	4·8	4·3
Nasal breadth	4	3·1	3·6	3·8	3·4
Nasal index	90·9	63·3	77·3	82·6	72·5
Vertex to tragus	14·6	12·7	13·7	14·1	13·4
Vertex to chin	22·9	18·3	20·9	21·7	19·8
Facial angle	75	64	70	72	68

TABLE X.

SUMMARY OF MEASUREMENTS.

PALLIS.

—	Max.	Min.	Average.	Mean above	Mean below
Weight	123	85	104·6	111·6	96
Height	169·4	151	162·5	166·7	157·5
Height, sitting	89·5	77·9	83·6	85·4	81·8
Height, kneeling	123·8	111	118·8	121·5	115·8
Height to gladiolus	128·8	114	121·5	125·9	117·8
Span of arms	182·2	159·6	172·6	177·6	167·9
Chest	85·5	72	79·2	81·8	76·3
Middle finger to patella	14·2	4·2	9·5	11·1	7·7
Shoulders	41·9	36·2	39·4	40·6	38·2
Cubit	49·3	41·6	46·2	47·7	44·6
Hand, length	19·7	16	17·9	18·7	17·1
Hand, breadth	8·9	7·4	8·1	8·4	7·7
Middle finger	12·1	10	11·4	11·8	10·9
Hips	27·3	24	25·5	26·5	24·6
Foot, length	27·6	23·3	25·5	26·4	24·6
Foot, breadth	10	7·8	8·9	9·3	8·4
Cephalic length	19·6	17·4	18·6	19	18·2
Cephalic breadth	14·6	12·1	13·6	14	13·2
Cephalic index	80	64·4	73	75·5	70·1
Bigoniac	10·8	9	9·9	10·3	9·5
Bizygomatic	13·6	11·9	12·7	13·1	12·3
Maxillo-zygomatic index	85·7	72·4	78	80·1	76
Nasal height	5·1	4·1	4·6	4·8	4·4
Nasal breadth	4·1	3·1	3·6	3·8	3·4
Nasal index	95·1	60·8	77·9	83·5	73·3
Vertex to tragus	14·6	12·5	13·8	14·2	13·4
Vertex to chin	22·5	19·3	21·1	21·7	20·7
Facial angle	76	63	69	71	64

TABLE XI.

SUMMARY OF MEASUREMENTS.

PARIAHS.

	Max.	Min.	Average.	Mean above	Mean below
Weight	128	91	106	114	99
Height	171·4	149·4	162·1	166·3	157·4
Height, sitting	89·9	76	84·5	86·8	82·7
Height, kneeling	127·2	109·4	119·4	122·7	116·4
Height to gladiolus	129·6	112·5	122·4	125·5	119
Span of arms	186·6	159·8	172·1	178	167·2
Chest	84·5	74·5	79·3	81·6	77·5
Middle finger to patella. ...	14	5·5	9·4	11·2	7·8
Shoulders	41·4	36·8	39·4	40·4	38·6
Cubit	49·7	42·5	46·1	47·7	44·9
Hand, length	19·6	15·5	17·9	18·5	17·3
Hand, breadth	8·8	7·4	8	8·3	7·9
Middle finger	12·9	10·4	11·4	11·7	11·1
Hips	28·2	24·1	25·9	26·8	25
Foot, length	28·8	24·2	26	26·9	25·2
Foot, breadth	10	8·1	9·1	9·5	8·7
Cephalic length	19·7	17	18·6	19·1	18·1
Cephalic breadth	14·5	13	13·7	14	13·4
Cephalic index	78·3	64·8	73·6	75·5	71·4
Bigoniatic	11·1	9·1	10	10·5	9·5
Bizygomatic	13·7	12·2	12·9	13·2	12·6
Maxillo-zygomatic index. ...	84·7	67·4	77·6	81·3	74·8
Nasal height	5·1	4·1	4·5	4·8	4·3
Nasal breadth	4·5	3·1	3·6	3·8	3·4
Nasal index	91·8	66	80	86	74·3
Vertex to tragus	14·9	12·9	13·8	14·2	13·4
Vertex to chin	23·2	19	21·3	22	20·6
Facial angle	75	62	68	71	66

TABLE XII.

COMPARISON OF MEASUREMENTS.
BRÁHMANS, KAMMÁLANS, PALLIS, AND PARIAS.

	Bráhmans.	Kammá-lans.	Pallis.	Pariahs.
Weight	115	100·4	104·6	106
Height	162·5	159·7	162·5	162·1
Height, sitting	85·4	82·5	83·6	84·5
Height, kneeling	119·2	117·4	118·8	119·4
Height to gladiolus	122·1	120	121·5	122·4
Span of arms	173·3	171	172·6	172·1
Chest	81	78	79·2	79·3
Middle finger to patella	10·1	8·4	9·5	9·4
Shoulders	39·3	39·2	39·4	39·4
Cubit	46	46·2	46·2	46·1
Hand, length	18·3	17·6	17·9	17·9
Hand, breadth	8	8·1	8·1	8
Middle finger	11·6	11·4	11·4	11·4
Hips	26	25·1	25·5	25·9
Foot, length	25·9	25·1	25·5	26
Foot, breadth	8·7	8·6	8·9	9·1
Cephalic length	18·6	18·4	18·6	18·6
Cephalic breadth	14·2	13·7	13·6	13·7
Cephalic index	76·5	75	73	73·6
Bigoniac	10	9·7	9·9	10
Bizygomatic	12·9	12·7	12·7	12·9
Maxillo-zygomatic index	77·7	76·2	78	77·6
Nasal height	4·7	4·6	4·6	4·5
Nasal breadth	3·6	3·6	3·6	3·6
Nasal index	76·7	77·3	77·9	80
Vertex to tragus	14·1	13·7	13·8	13·8
Vertex to chin	20·9	20·9	21·1	21·3
Facial angle	69	70	69	68









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